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EPONYMS.

By SIR D'ARCY POWER, K.B.E., London.

IV.—WILLIAM HEY, OF LEEDS.

The memory of William Hey, of Leeds, (1736–1819) still lingers in surgical literature. There are Hey's amputations of the leg and foot, Hey's saw, Hey's ligament, and Hey's hernia. He appears, too, to have been the first to give the name of Gimbernat to the lacunar ligament in the groin. The distance of Leeds from London and from Edinburgh probably prevented Hey from writing in the medical journals of the day; but he tells us that he early began the custom of committing to paper such cases occurring in his practice as seemed rare, or peculiarly instructive. These cases he collected and published under the title of *Practical Observations in Surgery, Illustrated with Cases.* The first edition was printed in London in 1803; the second edition in 1810; and the third, with a dedication to John Pearson, F.R.S., in 1814. Pearson lived for three years in Hey's house as a pupil, and afterwards wrote his master's life. The three editions of the *Practical Observations* differ somewhat from one another, and show that Hey maintained an active interest in surgery until the end of his long life.

HEY'S AMPUTATION OF THE FOOT.

"In the year 1797, a case occurred that led me to a new mode of operating, which, upon repeated trial, has fully answered my expectations, and in the year 1799, I had an opportunity of repeating this operation, and found it to answer perfectly my expectations.

"Mary Stansfield, aged eighteen years, of Holme in Lancashire, was admitted an in-patient of the General Infirmary at Leeds, under my care, on account of a caries in the metatarsal bones of one foot, upon whom I operated in the following manner.

"I made a mark across the upper part of the foot, to point out as exactly as I could the place where the metatarsal bones were joined to those of the tarsus. About half an inch from this mark, nearer the toes, I made a transverse incision through the integuments and muscles covering the metatarsal bones. From each extremity of this wound, I made an incision along the inner and outer side of the foot to the toes. I removed all the toes at their junction with the metatarsal bones, and then separated the integuments and muscles, forming the sole of the foot, from the inferior part of the metatarsal bones, keeping the edge of my scalpel as near the bones as I could, that I might both expedite the operation, and preserve as much muscular flesh in the flap as possible. I then separated with the scalpel the four smaller metatarsal bones, at their junction with the tarsus; which was easily effected, as the joints lie in a straight line across the foot. The projecting part of the first cuneiform bone, which supports the great toe, I was obliged to divide with a saw. The arteries which required a ligature being tied, I applied the flap, which had formed the sole of the foot, to the integuments which remained on the upper part, and retained them in contact by sutures. A speedy union of the parts took place, and the wound was healed, except a very small superficial sore, at the expiration of a fortnight. The foot was not so much shortened by this operation as might have been expected. For though the metatarsal bones which had been removed, are usually about three inches in length (I did not measure them in this case), yet the mutilated foot was but one inch

shorter than the sound foot, measuring from the heel to the root of the little toe ; the latter being eight inches, and the former seven in length.

" The patient could walk with firmness and ease. She was in no danger of hurting the cicatrix, by striking the place where the toes had been against any hard substance ; for this part was covered with the strong integuments, which had before constituted the sole of the foot. The cicatrix was situated upon the upper part of the foot, and had very little breadth, as the divided parts had been kept united, after being brought into close contact. The advantages of this operation will sufficiently appear upon inspecting the annexed plate (*Fig.* 468), in which the mutilated foot is accurately represented from a drawing made by Mr. Russell, of the Royal Academy, who happened to be at Leeds before this patient was dismissed from the Infirmary, and who favoured me with two views of the foot, elegantly painted in crayons."

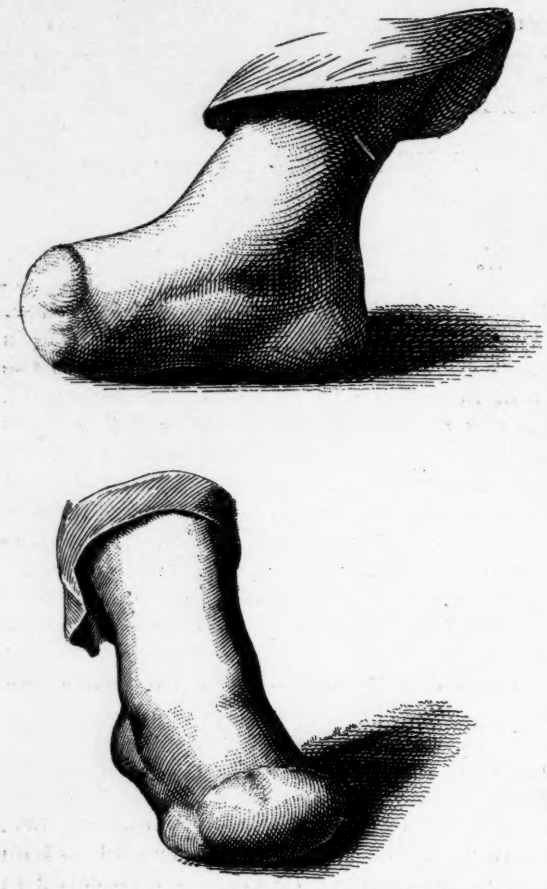

FIG. 468.—Hey's amputation of the foot at the tarso-metatarsal joints.

HEY'S SAW.

Hey appears to take no credit for the saw which is called after him, for he says : " If a saw could be contrived, which might be worked with safety in a straight, or gently curvilineal direction, it would be a great acquisition to the practical surgeon. Such a saw I can now with confidence recommend, after a trial of twenty years, during which time I have rarely used the trephine in fractures of the skull. Its use has been adopted by my colleagues at the General Infirmary in Leeds ; and will be adopted, I should hope, by every surgeon who has once made trial of it. It was first shewn to me by Mr. (now Dr.) Cockell, an ingenious practitioner at Pontefract, to whom the public is indebted for the discovery, or revival, of this excellent instrument. A saw, formed on the same principle is represented in Scultetus's Armamentarium chirurgicum ; but I understood Dr. Cockell to say, that the instrument which he shewed me was of his own invention, and that he had used it with great advantage in extensive fractures of the skull. Dr. Cockell's saw had a semicircular edge, as represented in the annexed Plate (*Fig.* 469), where the size of the figure is two-thirds of the real dimensions of the instrument. But the edge may be made straight (as is shewn in the Plate) or any degree of convexity which may be thought most useful. The straight-edged saw executes its task with greater readiness ; but the convex edge is necessary when the bone is to be sawed in a curvilineal direction. It is also useful when the thickness of that part of the cranium which is to be sawed out is very unequal.

" This instrument is worked with ease, if the pressure made upon it by the hand is light. It saves much time in cases of extensive fracture, where the repeated application of a trephine would have been needful ; and it may be used with less danger of wounding the dura mater, if the same precautions are used, in examining from time to time the depth of the groove, as is necessary in the use of the trephine."

The saws were made for Mr. Hey by Savigny, the well-known instrument maker in London. It will be noticed (*Fig.* 469) that the saw here recommended has two semicircular cutting edges. In the later editions of the *Practical Observations,* Hey has

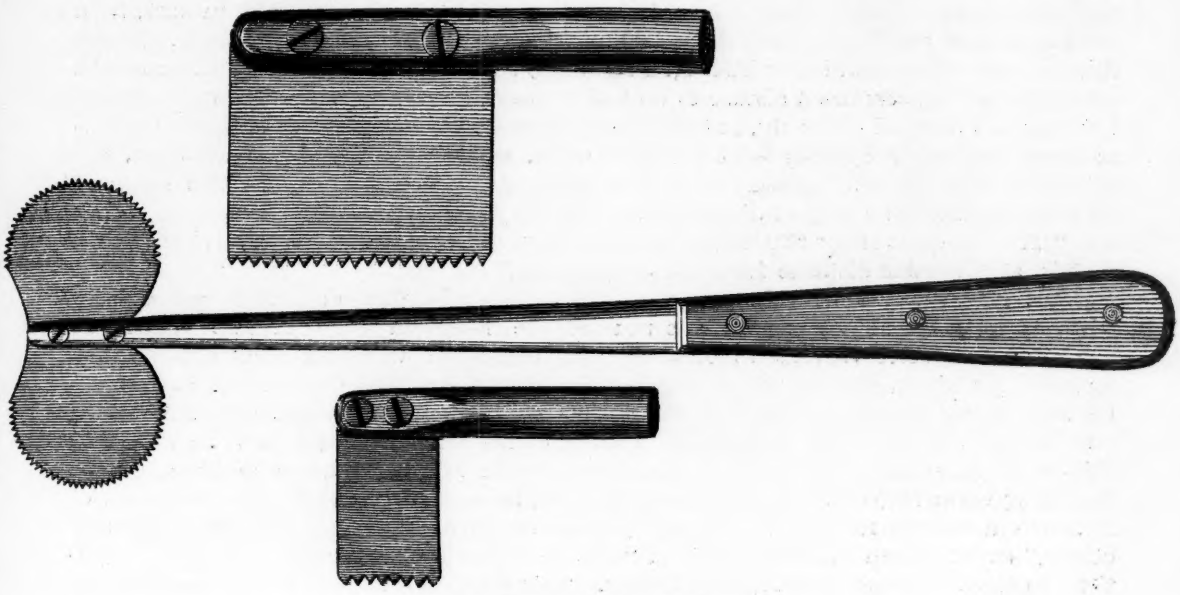

FIG. 469.—The first models of Hey's saws.

modified it to take its present form of one semicircular and one straight cutting edge which is somewhat convex.

HEY'S LIGAMENT.

Hey, like his contemporaries Astley Cooper and William Lawrence, was much interested in the anatomy of the parts concerned in hernia, and by the advocacy and example of these great surgeons early operation became the routine treatment for strangulation. The older treatment was by bleeding, purgative medicines, purging clysters, opiates, the warm bath, the cold bath, the application of cloths dipped in cold water, solutions of crude sal ammoniac, ice, ether evaporated on the part, and the injection of tobacco in fume or decoction. Indeed, says Hey, " when I first entered upon the profession of surgery, in the year 1759, the operation for the strangulated hernia had not been performed by any of the surgeons in Leeds. My seniors in the profession were very kind in affording me their assistance, or calling me into consultation when such cases occurred ; but we considered the operation as the last resource, and as improper until the danger appeared imminent. By this dilatory mode of practice I lost three patients in five. Having more experience of the urgency of the disease, I made it my custom, when called to a patient who had laboured two or three days under the disease, to wait only about two hours, that I might try the effect of bleeding (if this evacuation was not forbidden by some peculiar circumstances of the case) and the tobacco clyster. In this mode of practice I lost about two patients in nine upon whom I operated."

In starting out to consider the anatomy of the parts concerned in femoral hernia Hey says : " Don Antonio de Gimbernat, surgeon to the King of Spain, is the only author with whose works I am acquainted, who has asserted, that the strangulation in the femoral hernia is not caused by Poupart's ligament. He informs us, that he first demonstrated this in 1768, and afterwards in 1777 explained the subject to the late Dr. Hunter, by means of an anatomical preparation. His treatise induced me to examine repeatedly the parts

concerned in the formation of the femoral hernia and to procure drawings of the parts which I had dissected".

"In the femoral hernia the prolapsed parts descend within the aponeurotic sheath, which envelopes the great vessels of the thigh, and which is strongly attached at its superior part to the ossa pubis. The anterior layer of this sheath is formed, in part, by a continuation of the fascia of the abdominal muscles, passing down upon the thigh. About three-eighths of an inch below Poupart's ligament, there exists in this aponeurotic sheath another ligament, somewhat similar to that of Poupart, but smaller. It runs transversely, but does not descend obliquely, as that ligament does. On the contrary it rather ascends as it approaches the symphysis of the ossa pubis, passing behind, and decussating, the extremity of Poupart's ligament. As I shall have occasion to mention this ligament frequently, I shall, by way of distinction, call it the *femoral ligament.*

"This ligament is not situated in the same plane with that of Poupart, but lies deeper, that is, at a greater distance from the integuments."

Mr. Hey thought at this time that strangulation in femoral hernia was due to what is now called the superior cornu of the falciform edge of the saphenous opening; but after a visit to London and discussion with Sir Astley Cooper he modified his views, and in the second edition of the *Practical Observations in Surgery* he arrived at the conclusion that the strangulation was due to the structure which "to avoid a disagreeable periphrasis, I shall call Gimbernat's ligament". To settle this point Hey made two visits to London, once in 1805 and again in 1808. "The dissecting room in Windmill Street was open to him at all times by the politeness of Mr. Wilson and he received much civility from Sir Everard Home, Mr. Abernethy and others," says Pearson in his life of Hey, "but he deemed himself under particular obligations to the attentions of Mr. Astley Cooper. This gentleman showed him the anatomical preparations he had made, which tended to illustrate the object of Mr. Hey's inquiries; he discussed with great openess and candour the several points upon which Mr. Hey had doubts, or desired further information, and he dissected a recent subject in his private dissecting room, in Mr. Hey's presence, for the express purpose of demonstrating to that gentleman the parts concerned in the formation of femoral hernia. . . . During Mr. Hey's very short stay in London in 1808, he demonstrated upon a recent subject in the anatomical theatre in Windmill Street, the parts concerned in the femoral hernia according to his own conceptions of them, before a numerous and most respectable assembly of the anatomists and surgeons resident in the metropolis. His explanations were perspicuous and satisfactory but the time and attention which he employed in these researches in the dissecting room at his advanced period of life, [æt. 72] had a most unfriendly influence upon his health. . . . He became seriously ill on his journey to Leeds . . . and many months elapsed before he was capable of resuming his accustomed occupations."

The Great Windmill Street School of Medicine was opened by Dr. William Hunter in 1768, and after his death was carried on by Cruikshank and Mathew Baillie, who in turn were succeeded by James Wilson. Benjamin Brodie, who had acted as demonstrator in the school, began to lecture on surgery there in 1808, the year of Hey's second visit.

HEY'S HERNIA.

"An account of a new species of Scrotal Hernia. November 6th, 1764. I examined the body of a child, fifteen months old, who had died of a *strangulated scrotal hernia*, in the presence of Dr. Crowther, a physician who then lived at Leeds. . . . Having examined the contents of the abdomen without altering the state of the hernia, I made a longitudinal division of the scrotum on its right side, continuing my incision the whole length of the tumour, and laid bare, as I imagined, the hernial sac. This I opened towards its inferior part, which was the most prominent; but it proved to be the *tunica vaginalis testis*, containing, together with the testicle, a portion of the true hernial sac.

"This unusual appearance engaged me to prosecute the dissection with great care.

I found that the tunica vaginalis was continued up to the abdominal ring, and inclosed the hernial sac, adhering to that sac by a loose cellular substance, from the ring to within half an inch of its inferior extremity. The fibres of the cremaster muscle were evident upon the outside of the exterior sac, or tunica vaginalis. The interior or true hernial sac was a production of the peritoneum as usual, and contained only the cæcum or head of the colon. . . . Having removed the proper hernial sac, I examined the posterior part of the exterior sac, and found it connected with the spermatic vessels in the same manner as the *tunica vaginalis* is, when the testis has descended into the scrotum. An additional proof, that the exterior sac was the *tunica vaginalis.*

" From all these circumstances it is evident, that this hernia differed both from the common scrotal rupture, in which the hernial sac lies on the outside of the tunica vaginalis ; and also from the *hernia congenita,* where the prolapsed part comes into contact with the testicle, having no other hernial sac besides the tunica vaginalis."

Hey then proceeds to consider the manner in which the tunica vaginalis is developed and the way in which it closes, arriving at the conclusion that " This kind of scrotal hernia may not improperly be called *hernia infantilis,** as it can only exist when the rupture is formed whilst the parts retain the state peculiar to early infancy."

HEY'S INTERNAL DERANGEMENT OF THE KNEE-JOINT.

The name of Hey is undoubtedly best remembered in connection with the short chapter on " Internal Derangement of the Knee Joint ", a condition which he clearly distinguished from " loose Cartilaginous Substances in the Joints ", although he had no opportunity of examining a knee to determine the exact nature of the injury. He says, after a few preliminary remarks :—

" This joint is not unfrequently affected with an internal derangement of its component parts ; and that sometimes in consequence of trifling accidents. The disease is, indeed, now and then removed, as suddenly as it is produced, by the natural motions of the joint without surgical assistance : but it may remain for weeks or months, and will then become a serious misfortune, as it causes a considerable degree of lameness. I am not acquainted with any author who has described either the disease or the remedy ; I shall, therefore, give such a description as my own experience has furnished me with, and such as will suffice to distinguish a complaint, which, when recent, admits of an easy method of cure.

" This disorder may happen either with, or without, contusion. In the latter case it is readily distinguished. In the former, the symptoms are equivocal, till the effects of the contusion are removed. When no contusion has happened, or the effects of it are removed, the joint, with respect to its shape, appears to be uninjured. If there is any difference from its usual appearance, it is, that the ligament of the patella appears rather more relaxed than in the sound limb. The leg is regularly bent or extended by the hands of the surgeon, and without pain to the patient ; at most, the degree of uneasiness caused by this flexion and extension is trifling. But the patient himself cannot freely bend, nor perfectly extend the limb in walking ; but is compelled to walk with an invariable and small degree of flexion. Though the patient is obliged to keep the leg thus stiff in walking ; yet in sitting down the affected joint will move like the other.

" The complaint which I have described may be brought on, I apprehend, by any such alteration in the state of the joint, as will prevent the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages and articular depressions of the tibia. An unequal tension of the lateral, or cross ligaments of the joint, or some slight derangement of the semilunar cartilages, may probably be sufficient to bring on the complaint. When the disorder is the effect of contusion, it is most likely that the lateral

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* It is worthy of notice that the paper by Mr. Hamilton Russell in the present issue of the JOURNAL deals with the subject of Hey's infantile hernia. He calls it encysted hernia, and offers interesting explanations of the condition.

ligament on one side of the joint may be rendered somewhat more rigid than usual, and hereby prevent that equable motion of the condyles of the os femoris, which is necessary for walking with firmness. The method of cure, which I am about to propose, must not be used while there is any inflammatory affection, or swelling of the joint; but only when these effects of contusion are removed."

Mr. Hey then proceeds to give details of five instances occurring in four patients. Of these the second case is the best for purposes of illustration :—

"In 1784 the honourable Miss Harriet Ingram (now Mrs. Aston), as she was playing with a child, and making a considerable exertion, in stretching herself forwards, and stooping to take hold of the child, while she rested upon one leg, brought on an immediate lameness in the knee joint of that leg on which she stood. The disorder was considered as a simple sprain; and a plaster was applied round the joint. As the lameness did not diminish in the course of five or six days, I was desired to visit her.

"Upon comparing the knees, I could perceive no difference, except that, when the limbs were placed in a state of complete extension, the ligament of the patella of the injured joint seemed to be rather more relaxed than in that joint which had received no injury. When I moved the affected knee by a gentle flexion and extension, my patient complained of no pain; yet she could not perfectly extend the leg in walking, nor bend it in raising the foot from the floor: but moved as if the joint had been stiff, limping very much, and walking with pain.

"I thought it probable, that the sudden exertion might in some degree have altered the situation of the cross ligaments, or otherwise have displaced the condyles of the os femoris with respect to the semilunar cartilages; so that the condyles might meet with some resistance when the flexor or extensor muscles were put into action, and thereby the free motion of the joint might be hindered, when the incumbent weight of the body pressed the thigh bone closely against the tibia; and though this derangement was not so great as to prevent the joint, when relaxed, from being moved with ease.

"To remedy this derangement, I placed my patient upon an elevated seat, which had nothing underneath it that could prevent the leg from being pushed backward towards the posterior part of the thigh. I then extended the joint by the assistance of one hand placed just above the knee, while with the other hand I grasped the leg. During the continuance of the extension I suddenly moved the leg backwards, that it might make as acute an angle with the thigh as possible. This operation I repeated once, and then desired the young lady to try how she could walk. Whatever may be thought of my theory, my practice proved successful; for she was immediately able to walk without lameness, and on the third day after reduction she danced at a private ball without inconvenience, or receiving any injury from the exercise. In October, 1786 the young lady . . . had the misfortune to produce the same injury in her knee, in rising hastily out of bed. After the lameness had continued about a week, without any amendment, I was consulted. The method of cure above described was made use of, with the same immediate success."

PNEUMOCOCCAL PERITONITIS.

By J. E. McCARTNEY and JOHN FRASER, Edinburgh.

Among the acute abdominal emergencies of childhood, pneumococcal peritonitis ranks as one of the most serious; as one which is associated with perhaps the highest scale of mortality. Its occurrence is not confined to children, but the proportional incidence is so vastly greater in the child than in the adult that it has come to be looked upon as a disease of childhood and youth.

Even in childhood it cannot be described as a common disease. It is impossible to give figures by which to form an estimate of its proportional occurrence, but probably about 2 per cent of the abdominal emergencies of childhood are due to abdominal pneumococcal infection. In this connection, however, it must be noted that a proportion of pneumococcal peritoneal infections are not diagnosed as such, and the occurrence of the condition is more common than we realize. Evidence which may be said to support this assertion is afforded by statistics showing the admission figures of the disease during the years 1902, 1911, and 1920—the admissions were 4, 7, and 15 respectively. The probability is that, while the actual proportional occurrence has remained constant, the class of case is now more efficiently recognized and is submitted to surgical interference at an earlier period.

For certain reasons a study of the disease is attractive. Its mortality is so high that any additional knowledge which will tend to reduce that mortality must be welcome; the apparently idiopathic nature of the affection in certain cases stimulates investigation, and there are a number of clinical points which arise in connection with the disease and which are of interest from the symptomatic point of view.

An investigation has been made, therefore, of a series of 56 cases which have come under treatment at the Children's Hospital, Edinburgh. In this institution the age limit is fixed from birth to twelve years, and therefore the cases have all fallen within this period.

CLINICAL FEATURES OF THE DISEASE.

It is rational and convenient to introduce the subject with a consideration of the clinical features which characterize the disease. A systematic study of the case-histories suggests their division into two main groups: (*A*) *Primary Cases—Acute and Chronic*; (*B*) *Secondary Cases.*

In *Group A* it is understood that the peritoneal inflammation is the original manifestation of the disease, and in *Group B* the peritonitis is a secondary development, there being a previous pneumococcal infection in some other portion of the body (e.g., the lungs, pleura, etc.). In *Group A* a further subdivision is necessary. Clinically we observe two varieties of the primary pneumococcal infection—an acute and a chronic, according to the intensity and progress of the disease. *Group B* requires no subdivision, as the features associated with it follow a uniform course, generally subacute in character.

Typical Clinical Histories of the Disease.—Adopting therefore the above classification, we give the clinical histories of three cases, each of which may be regarded as typical of a different variety of the disease.

Case 1.—**Example of an acute primary pneumococcal peritonitis.**

A female child, age 6 years, was admitted to hospital on account of severe abdominal pain, persistent vomiting, and general prostration. The duration of the illness before admission only extended over twenty-four hours. In the morning the child had appeared to be in excellent health, and partook of a hearty breakfast. At 10 a.m., while playing with her companion,

she suddenly complained of severe abdominal pain, and half an hour later she was violently sick. She was put to bed, and throughout the day the pain continued, while the vomiting was persistent. During the night these features continued, but she made very little complaint, and in the morning her condition was one of collapse, with intervals of complete unconsciousness.

In this condition she was admitted to hospital. On admission she was unconscious—there was slight general cyanosis, temperature was 103°, the pulse uncountable, and the respiration-rate 50. The abdomen was rigid in its lower half; below the umbilical plane the percussion note was dull. On account of the loss of consciousness it was difficult to estimate the question of pain, but there appeared to be tenderness in both iliac fossæ.

Operation revealed an intense peritonitis, most marked in the lower abdomen. From the exudate pneumococci were isolated.

Within thirty-six hours of the onset of the illness the child succumbed. The case throughout presented the most intense features.

Case 2.—**Example of a chronic primary pneumococcal peritonitis.**

A female child, age 10 years. The illness extended over a period of three weeks before admission to hospital. Its onset was marked by colic-like pains in the lower abdomen, followed in a short time by profuse diarrhœa and intermittent attacks of vomiting. During the first week of the illness the trio of symptoms continued; but that they were not of extreme urgency may be inferred from the fact that during this time the child was not entirely confined to bed. During the second week of the illness the symptoms continued; the pain was still a prominent feature, but the diarrhœa and vomiting became less marked. During this week bodily weakness became noticeable, and there was considerable loss of flesh. She was now confined to bed. With the commencement of the third week the diarrhœa abated, and a new feature made its appearance in the shape of a tender swelling in the lower abdomen. At this time frequency of micturition and pain on micturition appeared, while there were recurrent attacks of colic.

The child was admitted to hospital exactly three weeks after the onset. A summary of her condition on admission may be expressed as follows: A pale, emaciated girl. Her general appearance was one of extreme nervous irritability. The mouth and lips were dry, the temperature was 102°, and the pulse-rate 120. Abdominal examination showed a rounded tender swelling extending in the middle line to the level of the umbilicus and filling the pelvis. There was a leucocytosis of 20,000, and a well-marked glycogenic reaction. Laparotomy showed the presence of an encysted abscess in the pelvis and lower abdomen: its contents were in keeping with a pneumococcal infection and pneumococci were isolated from the exudate.

The outstanding features of *Case* 2 were: The long-drawn-out history—three weeks. The chronicity of the disease from its commencement, as evidenced by the fact that during the first week of the illness the child was only confined to bed at intervals. The gradual formation of an encysted abdomino-pelvic abscess.

Case 3.—**Example of a secondary pneumococcal peritonitis.**

A male child, age 1 year and 8 months. Four weeks before admission the patient had an attack of bronchitis which eventually developed into pneumonia. After a period of grave illness the child, at the end of three weeks, appeared to be well on his way to recovery. For three days he had been able to be carried out of doors, and his condition was eminently satisfactory, when he began to complain of pain which he referred to the left upper quadrant of the abdomen. Fever returned, general malaise developed, and there was vomiting. Jaundice formed an item in the case.

When the child came under observation in hospital he displayed the features associated with a localized peritonitis. The abdominal rigidity was most marked on the left side, and the various evidences of inflammation were more pronounced in the upper than in the lower abdomen.

Laparotomy showed a subacute pneumococcal peritonitis: the evidences of the infection were chiefly in the upper left quadrant of the abdomen.

It is but natural that greater interest should attach to an investigation of the primary than to the secondary type, because in the former we have the stimulus of attempting to explain the apparently spontaneous involvement of the peritoneum by the pneumococcus. Therefore the following remarks are concerned entirely with the *primary type*.

A. THE 'PRIMARY' VARIETY, ACUTE AND CHRONIC.

Recognizing then such different varieties of the disease, each with its characteristic history, the object of this contribution is to discuss certain aspects of the primary type of pneumococcal peritonitis—the type which in literature is sometimes spoken of as the

'idiopathic' variety. The term 'idiopathic', when applied to pneumococcal peritonitis, has been used to convey the impression that, while the exciting cause was an infection of the peritoneum by the pneumococcus, no visceral lesions were apparent as the source from which the infection arose; in contradistinction, for example, to the peritonitis secondary to appendicular infection.

The various aspects of the disease which we propose to discuss are: (1) *The mode of infection*; (2) *Clinical peculiarities of the disease*; (3) *Modern methods of treatment.*

1. THE MODE OF INFECTION.

With regard to the mode of infection of the peritoneum in primary cases, the organism might conceivably reach the peritoneal cavity in several ways, namely: (*a*) By the blood-stream; (*b*) By the intestinal tract through the gastro-intestinal mucous membrane; (*c*) By direct extension from the throat by the lymphatics from the mediastinum; (*d*) Through the Fallopian tubes from the vagina in the female. Let us summarize the evidence which exists for or against each of these various possibilities.

a. **By the Blood-Stream.**—Rischbieth, in a comprehensive paper published in 1910, put forward strong claims in support of the view that primary pneumococcal peritonitis was in reality a secondary peritonitis, being secondary to a generalized blood infection. He states: "Pneumococcal peritonitis . . . is always secondary, not to a single focus of disease, but to a septicæmia. The view that the condition is secondary to pneumococcal septicæmia is the only one which explains all cases."

There are, however, certain strong objections to the adoption of the theory of the hæmic infection, and Rischbieth's paper has failed to controvert them.

In support of his view, Rischbieth asserts that pneumonia has a hæmatogenic origin, being produced by organisms conveyed to the lung in the blood-stream. This contention is apparently founded on the fact that the pneumococcus was shown to be present in the blood at the time of onset of clinical symptoms of pneumonia, or, in occasional instances, before the clinical symptoms of pneumonia had appeared. In point of fact, however, pneumococci can be obtained from the blood in practically every case of pneumonia. The hæmatogenic view of the cause of pneumonia has been definitely disproved by the recent work of Blake and Cecil. These observers showed that it was only by intratracheal injection of pneumococci that pneumonia could be produced in monkeys, and that a quantity as small as a millionth of a cubic centimetre of a broth culture was sufficient always to induce a severe or fatal case of the disease. Under these conditions it was found that organisms appeared in the blood-stream within six to twenty-four hours after injection, frequently before clinical evidence of pneumonia or elevation of temperature had developed. Moreover, Blake and Cecil showed that by intravenous injection of pneumococci a fatal septicæmia was produced, and in no case did either pneumonia or peritonitis occur. These experiments of Blake and Cecil have an important bearing on the subject under discussion, as we believe that an analogous condition occurs in peritoneal infection.

As pneumococci gain access to the blood-stream in practically every case of pneumonia, one would expect that pneumococcal peritonitis would be a very common complication of pneumonia if Rischbieth's view were correct. Actually, peritonitis is a rare sequel to pneumonia. Rolleston's figures are 11 cases of peritonitis in 4454 cases of pneumonia, or 0·24 per cent. Surely there would be a bigger percentage than this if peritonitis were caused by blood infection. Moreover, in these 11 cases the probability is that there were some where the infection was conveyed from the pleura through the diaphragm by lymphatics to the peritoneum, which would still further reduce the percentage of cases which could have been due to the organisms being carried in the blood.

The last point of evidence in opposition to the hæmic infection arises in regard to the morbid anatomy of the disease. It is alluded to more fully later; but at this stage it may be stated that clinical, pathological, and bacteriological evidence is in favour of the disease beginning as a pelvic peritonitis. If this observation is correct (and we possess

strong evidence in its favour), it is difficult to understand why a septicæmia should pick out a localized portion of the peritoneum for an inflammatory reaction, and, moreover, one of the most resistant portions of the peritoneum.

These are strong objections to the theory of hæmic infection.

b. **By the Gastro-intestinal Tract.**—It has been suggested that the infection passes through the wall of the intestinal tract and so induces a peritoneal infection. This view has been based on the demonstration of two features—the occurrence of pneumococci in the intestinal flora, and the presence of the organism in pneumococcal peritonitis in the subperitoneal tissues of the intestinal wall (Stoos). Both observations are undoubtedly correct, but neither justifies the adoption of the view that the gastro-intestinal tract is the avenue of infection. In regard to the first, the pneumococcus is frequently a resident among the intestinal flora, but its occurrence is never a common one. The second feature —the demonstration of the pneumococcus in the intestinal wall in cases of pneumococcal peritonitis—is most likely an example of an invasion of the wall from the peritoneal surface: its occurrence in the wall apart from an overlying peritoneal infection has never been demonstrated.

Two other facts tend to contradict the intestinal theory. If infection occurred from the mucous surface outwards it is practically necessary to assume that a mucous lesion pre-existed, which permitted of the invasion of the wall. Careful investigation of a number of cases of pneumococcal peritonitis under our care has failed to demonstrate the occurrence of any lesion of the intestinal mucosa. Finally, Jensen investigated the theory from an experimental aspect. He fed rabbits with virulent cultures of pneumococci, and in one instance caused peritonitis; but he himself states that it was a terminal infection, and occurred late in the disease, and was a result of direct extension through the very inflamed gut wall.

We have repeated Jensen's experiments on an extended scale, but up to the present we have completely failed to produce peritonitis. Young rabbits were fed with as much as 10 c.c. of a broth culture of virulent pneumococci, of which 0·001 c.c. was sufficient to cause death in twenty-four hours when injected subcutaneously. Others were fed with sodium bicarbonate and with sodium bicarbonate and tincture of opium (to neutralize gastric juice and slow intestinal movements) before administration of pneumococcal cultures. All the animals remained perfectly healthy.

We possess, therefore, no direct evidence in favour of the gastro-intestinal route of infection.

c. **By the Lymphatic Route.**—The possibility has to be considered that the infection may have passed into the lymphatic stream through the tonsillar, pharyngeal, or bronchial glands, and, passing thence to the subperitoneal lymphatics, may be responsible for a generalized peritoneal infection. It seems unnecessary to adopt such an unlikely possibility when more obvious routes exist, but the question must be considered. If we accept the lymphatic theory of infection, we must believe that a massive lymphatic infection occurs such as has no parallel in pathology. Further, we must recognize that the infection extends in a direction contrary to the normal lymph flow. These are two possibilities which no evidence supports, and in the absence of it, they very naturally cannot be accepted.

d. **By the Genital Tract in the Female.**—The peritoneal cavity of the female possesses one characteristic which distinguishes it very sharply from that of the male—it is in communication with the exterior through the medium of the genital tract. Such a characteristic naturally suggests that this channel may be the medium through which infection enters the peritoneal cavity. The importance of the genital channel as a possible route of infection is becoming increasingly evident. It is recognized that a gonococcal peritoneal infection occurs in this way, and Milcher has recently produced strong evidence that some cases of tuberculous peritonitis in the female owe their development to a genital infection. In a group of 14 cases which he examined with remarkable thoroughness, he was able to demonstrate conclusively that 12 of them owed their origin to infection which had extended from the internal reproductive organs.

But, if the argument is to be considered in connection with pneumococcal peritonitis, one basal fact must first be established, for upon it the whole question necessarily depends :

Is Primary Pneumococcal Peritonitis peculiar to the Female ?—We believe that a positive answer is the correct one to such a question. Before we state our reasons for giving such an answer, the importance of the term 'primary' must be insisted on. By the use of this adjective we mean that variety of pneumococcal peritonitis in which no demonstrable lesion can be found in any other part of the body, such as the lungs, pleura, or joints. Peritonitis in association with these we would speak of as secondary, and of course we recognize that the term 'primary' is never strictly correct ; but we employ it in this connection in contradistinction to the variety which is obviously a secondary development. With this explanation we believe that primary pneumococcal peritonitis is a disease peculiar to the female sex.

In a study of 56 cases we have never found an example of the primary variety occurring in the male. In the total series which we have under review, 12 boys were affected and 44 girls. We have taken the utmost care in the investigation of the cases, and it has been our experience that in each of the 12 male cases the peritonitis was a secondary development. The accompanying table shows in greater detail the elaboration of this point :—

PNEUMOCOCCAL PERITONITIS IN 12 MALE CASES.

CASE NO.	CASE RECORD
4	Right lobar pneumonia under treatment before peritonitis apparent
8	Two previous attacks of pneumonia ; a third attack preceded the peritonitis
11	Lobar pneumonia preceded the peritonitis
12	Right lobar pneumonia preceded the peritonitis
13	Empyema preceded the peritonitis
18	Lobar pneumonia preceded the peritonitis
28	" " "
33	" " "
37	" " "
39	" " "
41	" " "
50	" " "

It is of interest, though it does not strictly concern us at this point, that the development of the peritonitis was in the great majority of cases secondary to a lobar pneumonia (10 cases) as opposed to a bronchopneumonia (1 case) ; further, that a right-sided pneumonia was the most common situation of the disease.

Of the 44 cases which occurred in girls, 8 were examples of secondary peritonitis : that is to say, there was a preceding pneumococcal chest infection.

There remains therefore a group of 36 cases which we regard as examples of primary pneumococcal peritonitis, and these without exception developed in girls. Thus, at this stage, as far as our clinical experience goes, the evidence is entirely in favour of primary pneumococcal peritonitis being confined to girls.

The next point for consideration is—What are the evidences which exist in support of the view that the infection occurs along the female genital tract ?

Evidence in Support of the View that Primary Pneumococcal Peritonitis arises as the Result of Infection along the Genital Tract.—The evidence available is wide and divergent, and of course it is additional proof that the primary infection only exists in the female sex.

It is Mainly a Disease of the Poorer Classes of Society.—This observation has been made repeatedly. Men of long surgical experience have recorded that they have never seen an example of primary pneumococcal peritonitis in private practice. Other pneumococcal infections do not possess this peculiarity—both pulmonary and non-pulmonary manifestations are only slightly more common among the poor than among the well-

to-do. It is the dirty, neglected, unhygienic child who contracts primary pneumococcal peritonitis owing to imperfect genital hygiene, a direct contamination of the parts, and close association with other children.

We had noticed on examining numerous vaginal smears from young children for gonococci, etc., that sometimes large numbers of organisms resembling pneumococci were present. On making cultural investigations from young girls, we found that it was possible to isolate pneumococci from a number of cases, and moreover, on inoculating mice, some of these strains were pathogenic. It was, however, only from the neglected, dirty children of the lowest classes that pneumococci were obtained. We failed to isolate the organism from better-class patients.

Thus it is seen that pathogenic pneumococci may be found at the entrance of the female genital tract.

Bacteriological Evidence in favour of the Genital Tract.—In the last 10 cases of acute primary pneumococcal peritonitis operated upon at the Children's Hospital, swabs were taken from the lower and upper regions of the peritoneal cavity, from the vagina, and from the throat. Blood cultures were also made. Pneumococci cultivated from the above sources were typed with Rockefeller type sera. In all cases the examination (by film preparations and culture) of the swabs taken from the peritoneal cavity showed evidence of a much heavier infection in the pelvis than in the upper abdomen. Actually, in one early case, we failed to find organisms in the upper part of the abdomen, but easily demonstrated pneumococci in exudate from the pouch of Douglas.

In every case pneumococci were isolated from the vaginal swab, and the blood culture always showed an abundant growth of pneumococci. In each individual the organisms isolated from the abdomen, vagina, and blood-stream were all of the same type.

In 1 case the pneumococci isolated from the abdomen, vagina, and blood-stream were all of Type I, whereas pneumococci obtained from the throat belonged to Type IV. In 8 cases the infection was due to a Type I pneumococcus, and in 2 cases to a Type II pneumococcus. This is of interest, as infections due to Type II pneumococcus are rare in children.

These bacteriological observations furnish evidence entirely in favour of the theory of infection by the genital tract :—

i. The isolation of the same type of organism from the blood, vagina, and peritoneal cavity.

ii. In one case the pneumococcus isolated from the throat was of a different type from the organism causing the infection.

iii. The isolation of pneumococci from the vagina, blood, and pelvis, while it was not possible to demonstrate the organism in the upper portion of the peritoneal cavity.

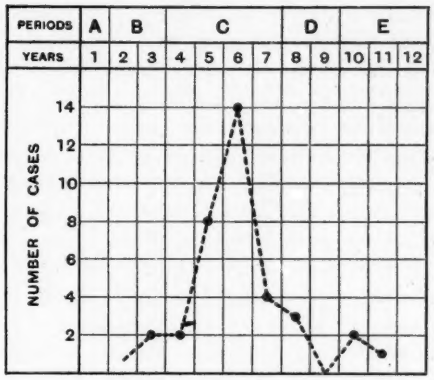
We attach considerable importance to the last observation, as demonstrating that the infection is at first localized to the pelvic peritoneum, instead of being general from the beginning, as some observers have stated.

Another point of interest is that pneumococci can be isolated from the blood-stream even in the very early cases. It is on this phenomenon that several writers have based their theory of the hæmic origin of the infection. As a matter of fact, organisms reach the blood-stream from the peritoneal cavity in a very short space of time. Jensen first showed that pneumococci could be demonstrated in the blood-stream of a rabbit a few minutes after intraperitoneal injection of a virulent culture. In a series of similar experiments we were able to demonstrate pneumococci in blood from the ear vein of a rabbit four minutes after intraperitoneal injection of pneumococci. One would expect, therefore, to find organisms in the blood-stream in early cases.

C. J. Bond, in his experiments, demonstrated the presence of an ascending mucous current in the genital tract, and he showed that the introduction of colouring matter into the vagina led to its eventual distribution over that portion of the parietal peritoneum with which the fimbriæ of the tubes are in contact. An obvious channel therefore exists for the passage of a pneumococcal infection from the vagina to the pelvic peritoneum.

The Age Incidence of the Disease.—If we examine in detail the age incidence of the cases of primary pneumococcal peritonitis, an interesting fact is brought out, and one which has considerable significance in its relationship to the etiology of the disease. If we divide the age period up to the twelfth year of life into five different groups—to the end of the first year, from one year to three years, from three years to seven years, from seven years to nine years, and from nine years to twelve years—and if now upon this scheme we plot out the relative occurrence of the disease, the table below appears :—

The remarkable feature is the preponderance of the disease during the period from the third to the seventh year, and in a more detailed analysis we find that it is the fifth and sixth years which show the most frequent occurrence. One naturally seeks for an explanation of such a distinctive incidence, and there are two points with an anatomical bearing which possibly may play a part in the explanation.



A = up to 1 year
B = 1 year to 3 years
C = 3 years to 7 years
D = 7 years to 9 years
E = 9 years to 12 years

The first is in relation to the patency of the female vagina. At birth the walls of the vagina are in close contact, and the epithelial separation may actually be incomplete ; it may be only after the third year that free separation is fully established. This anatomical point may therefore to some extent afford a key to the solution, because an ascending infection is most likely to occur after the separation has become complete.

The second point is in relation to the reaction of the vaginal secretion. Up to a period between the seventh and eighth years of life the vaginal secretion of the child is alkaline in reaction ; after that period it becomes acid. It has been suggested that during the period of the alkaline reaction the tendency to infection is greater than it is at a later stage.

Clinical Evidence in Favour of the Infection beginning as a Pelvic Peritonitis.—Though we propose later to detail the clinical features of the disease, we may summarize at this stage certain evidences which point to the fact that the primary type of pneumococcal peritonitis begins as a pelvic infection.

There are certain symptomatic evidences. In early cases the pain is referred to the suprapubic region. Pain on micturition and frequency of micturition are features frequently described. There is the diarrhœa which so often forms a distinctive symptom in pneumococcal peritonitis ; we believe that it is due to an irritation of the pelvic colon and the lower coils of the ileum, and it is an evidence of a pelvic peritonitis just as it is an indication of pelvic peritonitis in the abscess complication which develops secondary to appendicitis.

Operation reveals certain facts which afford evidence in favour of infection by way of the genital tract. We believe in the efficacy of early operation, and therefore we have had repeated opportunities of observing the degree and distribution of the infection in the early stages of the disease. Our experience has uniformly been that in the early stages of the condition the infection is purely one of the pelvic peritoneum ; and further, it is localized in its earliest beginnings to the peritoneum which lies in the neighbourhood of the Fallopian orifices.

Conclusion Regarding the Mode of Infection.

We believe that where the primary variety of pneumococcal infection is concerned, the disease is confined to the female sex ; and this peculiarity is explained by the fact that the infection is a direct one through the genital tract. The evidence which we possess is in favour of this conclusion.

2. CLINICAL PECULIARITIES OF PRIMARY PNEUMOCOCCAL PERITONITIS.

In any consideration of the clinical features it has to be recognized that there are two types of the primary disease, and that these two types are as widely apart in the acuity of symptoms as it is possible to be. One variety of the acute type may constitute the most sudden abdominal emergency, with death soon after twenty-four hours (*Case* 1). On the other hand, the disease may be so chronic in its character as to lead to its confusion with such a condition as tuberculous peritonitis (*Case* 2). It probably would afford a more satisfactory classification to recognize three varieties of the primary disease —fulminating, acute, and chronic. It is to be supposed that variations in the infecting organism are responsible for the divergence of the clinical features.

The clinical pecularities of the disease are best seen and studied in a moderately acute case, one in which the special points of the disease are not masked on the one hand by the extreme toxicity of the infection or on the other by the mildness of the disease.

Sequence of Events in a Typical Case.—In such a case the clinician will be able to recognize that the disease runs through a definite sequence of events. There is the introductory period during which the infection is localized, and we believe localized at first to the pelvic peritoneum. About the third day (sometimes earlier, sometimes later, depending on the acuteness of the infection) the disease enters on its second stage, the stage of general infection of the blood-stream—the stage of septicæmia. This is the critical period of the disease. Symptomatically it can be recognized by what is often a dramatic change in the clinical picture—restlessness, cyanosis, quickened respiration, exaggerated action of the alæ nasi, delirium, hyperpyrexia, and increased rapidity of the pulse-rate.

A certain number of cases may never enter upon this stage ; they are the more chronic types, which remain encysted and localized from the beginning ; but if this stage is definitely entered on, the prognosis instantly becomes one of extreme gravity, and in a considerable proportion of the cases the disease will proceed to a fatal termination.

The subdivision of the clinical history into introductory and septicæmic stages is important from the prognostic and diagnostic points of view, and also, as we shall endeavour to show, from the point of view of treatment.

Individual Peculiarities of the Disease.—Apart from the two more general characteristics of the type of the disease and the sequence of its events, there are certain local manifestations which give the disease a distinctive character. One of the most striking of these is the excessive vomiting during the early acute stage ; it is sometimes so intense that it has been suggested it is the result of the action of the pneumococcal poison on the central nervous system ; it is certainly very different from the reflex vomiting of an appendicular infection, and it appears too early in the case-history to be obstructive in its origin.

Diarrhœa is the second feature which we would describe as characteristic of the disease. Of the 36 cases of primary peritonitis with which the series is concerned, in 32 there was a history of diarrhœa in the early stages. The 4 exceptions were all examples of the fulminating type.

It is interesting to notice that among males, whom we believe to be subject only to the secondary variety of the disease, there were no examples of the diarrhœic symptom. Such a sex distinction is important in view of our thesis regarding the etiology. In certain instances the diarrhœa was accompanied by rectal tenesmus and the passage of blood-stained mucus. This symptom is a strong evidence of a pelvic peritonitis, as it is the result of an irritation of the terminal portion of the ileum and the pelvic colon.

A third distinctive group of symptoms are those associated with the bladder—frequency of micturition, and pain on micturition. Their recognition is valuable in so far as they add yet another feature to the group of symptoms which point to pelvic irritation in the early stages of the disease.

The last point to which we would draw attention (and it is one to which we have alluded already) is the change in clinical features coincident with the stage of septicæmia.

The abdominal aspects of the case become masked by the acute general signs and symptoms of a pneumococcal septicæmia.

Pathological Changes.—We do not propose to enter into a detailed account of the pathological changes—only points of special interest or application are alluded to.

Operation Findings.—At operation in the early cases the only lesion to be seen is a film of exudate, which is of an oily or sticky character, over the pelvic viscera. This exudate has at first a tendency to cause the adhesion of peritoneal surfaces; this tendency, however, disappears as the effusion becomes more fluid.

After twenty-four hours have elapsed, the exudate becomes watery and profuse, of a brownish colour, with flakes of lymph and fibrin. It is only during and after the fourth day that the exudate becomes definitely purulent. This evidence of a delay in leucocyte migration is an indication of the intensity of the disease, and, from the point of view of prognosis, we pay considerable attention to the character of the effusions, for we believe undue delay in the appearance of purulency is an unfavourable aspect in the prognosis.

The peritoneum is of a plum-coloured and congested appearance. The small intestine is distended. The Fallopian tubes were carefully examined. The fimbriæ are congested, and on several occasions we have been able at operation to expel muco-purulent material from the interior of the tubes. The chlorides in the urine from these cases were estimated, and in a few cases estimations of blood chlorides were carried out. The urine showed a reduction of chlorides. Blood chlorides were reduced in amount. Even in the early cases there is definite leucocytosis, and when the condition reaches the septicæmic stage we have been able to demonstrate an increase of the H ion content of the plasma.

Post-mortem Findings.—At all post-mortem examinations careful search was made for other foci of pneumococcal infection, but none was found. In the last series of cases the middle ear was particularly examined, but with negative results.

The Fallopian tubes in all cases were congested, and on section a catarrhal inflammation was present. Pneumococci were invariably demonstrated in the tubal secretion.

The solid viscera showed the usual toxic changes.

3. SOME ASPECTS OF THE TREATMENT OF THE DISEASE.

Rischbieth, in the paper which we have already quoted, takes a pessimistic view of the mortality of the disease, and there is justification for his pessimism when he recounts that the total mortality averages 88·8 per cent in the collected statistics from the London hospitals. He has apparently been so impressed with the hopelessness of many of these cases that he advises no operative interference should be attempted, except in the more chronic variety of case, where the disease has become encysted. He demonstrates that in this variety of the disease operation is followed by a mortality of 30 per cent.

Upon this question we take an entirely different view. We believe that early operation affords the best prospects for recovery. As soon as the condition is recognized, drainage of the peritoneal cavity is carried out under gas and oxygen anæsthesia. The drainage is at the most dependent point, and some of our best results have followed vaginal drainage. Until the period of the last year the early drainage operation might be said to summarize our line of treatment, but during the past twelve months we have improved the position by the addition of blood transfusion. This adjunct has already improved our post-operative results, and in the future we look forward to a greater reduction in the mortality. The transfusion is done by the citrate method, and the parents, if suitable, act as donors. It is important to recognize the precise time at which it can be done with the greatest possible advantage. That point is when the evidences of septicæmia are just beginning to make their appearance. This is very definitely the period of election: if done earlier the transfusion does not appear to prevent the onset of the septicæmia; if done later the heart may be so weakened that the quantity of blood which can be safely introduced is so small that relatively little beneficial effect can be looked for.

As regards the quantity of blood which can be given to a child, say, of six years, we

aim at the administration of 250 c.c. of blood. The change which the administration induces is often dramatic—the cyanotic tinge disappears and is replaced by a healthy, rosy colour, the restlessness abates, the pulse-rate slows, and the patient often drops into a sound sleep.

Perhaps the most striking testimony to the value of blood transfusion in pneumococcal peritonitis is evidenced in the following mortality figures :—

Taking the total number of cases operated on at the Children's Hospital during the past twenty years, the mortality figure averaged 65 per cent. During the year 1920 the mortality figure was 53 per cent, an improvement which we ascribe to earlier recognition of the cases, to earlier operation, and to more suitable methods of anæsthesia. During the year 1921, in which blood transfusion has been adopted as a routine at the critical stage of the disease, the mortality figure has fallen to 42 per cent.

SUMMARY.

1. There is an essential division of pneumococcal peritonitis into two classes—primary and secondary.

2. The primary class is peculiar to the female sex, because it is the result of infection of the peritoneal cavity from the genital tract.

3. The primary type, according to the acuteness of the infection, may be subdivided into three different varieties—fulminating, acute, and chronic.

4. Primary pneumococcal peritonitis begins as a pelvic peritonitis, and in a typical case the clinical features afford strong evidence of the pelvic distribution.

5. The course of the disease shows two distinct stages—introductory and septicæmic.

6. The mortality figures of the disease have been greatly diminished by the adoption of blood transfusion at the commencement of the septicæmic stage of the disease.

Our thanks are due to Professor Sir Harold Stiles for the access which he gave us to earlier case-records, from which we derived valuable statistical evidence.

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A CASE OF EPILEPSY OF 22 YEARS' STANDING DUE TO A CALCIFIED ENDOTHELIOMA OR PERITHELIOMA IN THE LEFT LATERAL VENTRICLE: REMOVAL AND RECOVERY.

By Sir JOHN LYNN-THOMAS, K.B.E., C.B., C.M.G., Cardiff.

I am indebted to my late house surgeon, Dr. Fergus Armstrong, for the following clinical history.

Mrs. C. L., housewife, age 48, was admitted to the Cardiff Infirmary, June 3, 1911, suffering from epilepsy which had existed on and off for twenty-two years. During this period she had been seeing medical men continually, and also quacks. Patient is a thin anæmic woman. Pulse 84. Temperature 98·4°. Has a severe headache of the left frontal region. She was sent for treatment by Dr. C. A. Jones, Penarth, after consultation.

History.—There is no trace of any mental or nerve trouble in parents and family. There is no evidence of syphilis, tuberculous disease, or of epilepsy in the family. There is one child alive and healthy at the age of 13 years. Patient has suffered previously from rheumatism, and frequent colds. Had an operation for dysmenorrhœa many years ago.

Present Illness.—This dated back for twenty-two years, when she had a very bad attack of twitching of the right side. It began in the right ring-finger and fingers, and spread up the arm and down the whole of the right side of the body. She did not lose consciousness during the attack. A recurrence came one year later. These fits returned at intervals of about nine to twelve months for about fifteen years. At about the latter period she noticed a weakness of her right hand when playing the piano—the right ring-finger being practically useless. The convulsions gradually became more severe, and she consulted Dr. Long Fox, of Bristol, and was under his care for about a year, with no benefit to the fits. Later on, the attacks became more frequent and severe, and she lost consciousness on six occasions; for the past three years the fits returned about every fourteen days and lasted for about half an hour to three hours.

Examination of Nervous System.—

Subjective Symptoms.—

Headache.—Is confined to the left frontal region, is of a dull aching character, and has been severe, especially of late. It occurs chiefly in the morning before breakfast and improves towards midday. Another attack comes on in the evening, but is not so severe.

Fits.—The first fit occurred at the age of twenty-six. No assigned cause. Interval of a year between each fit for the first fourteen to fifteen years. Latterly fourteen days' interval only. The onset is gradual, beginning with twitchings of the fingers of the right hand, and spreads over the right side to the right leg. Has lost consciousness on six occasions. Shortest attack lasts about half an hour, the longest three hours. Clonic contractions. Headache often after a fit, but there is no aura present. Paralysis of right side results for an hour or two after a fit, and a marked Babinski, which gradually lessens after the attack. Attacks of *motor aphasia* often follow fits.

Objective Symptoms.—

1. *Intellectual functions.*—The only one involved is speech; for the past year this has been the case, and she has noticed a lack of expression in words when addressing her servant: is always worse after an attack. Writing has been impaired, not from agraphia, but from muscular weakness of the right hand.

2. *Cranial nerve functions.*—No abnormality detected. Has not noticed any difference in sense of hearing, smell, taste, or vision.

3. *Motor functions.*—The muscular power of the right limbs is impaired. Power of grasp and all movements of the right limbs are markedly diminished. Gait has been interfered with during the past year: she drags her right leg a little and cannot raise it. Muscular nutrition of the right side is impaired, being especially marked in muscles of the arm, which are wasted and flabby.

4. *Sensory functions.*—Pain, heat, cold, and touch sensations are all diminished over the right side, in both limbs and trunk, and are most marked over the front of the forearm. There is complete loss of the stereognostic sense in the right hand (astereognosis).

5. *Reflexes.*—

Superficial reflexes: Babinski's is very marked, and particularly so after a fit; but is always present on the right side. Left plantar reflex is flexor.

Deep reflexes: Knee-jerk and all other deep reflexes are markedly exaggerated on the right side; ankle-clonus is present. Left side normal.

Organic reflexes: Deglutition, defæcation, and micturition are normal, and the sphincters are not involved.

6. *Vasomotor and trophic changes.*—No joint or skin changes are observable.

Ophthalmic Examination, July 7, 1911.—Report by Dr. D. Leighton Davies, ophthalmic surgeon. Pupils react to light and accommodation; both optic discs are normal, but there is a distinct enlargement of veins in the left fundus.

Radiogram, July 6, 1911.—Report by Dr. Owen Rhys, radiologist, Plate taken with anticathode centred over the temporosphenoidal region. Two plates show a distinct dark mass, about ½ inch above the pinna of the left ear.

Operation, July 7, 1911.—The operation was performed with the patient in the Albert Kocher's position for goitre; open ether was given by Dr. Alexander Brownlee. The Rolandic area was mapped out by Bennet's method. At right angles to the sagittal suture two parallel lines were drawn: (*a*) The anterior ran along the anterior margin of the external auditory meatus; (*b*) The posterior touched the posterior margin of the mastoid (MacEwen). These two lines were scratched on the scalp after the fashion introduced some years ago, and became prominent on being painted over with tincture of iodine. The two temporal blood-vessels were controlled by a temporary thick-thread ligature under-running. A 'C'-shaped incision was now made in the scalp down to the bone, and the scalp adequately reflected. The flap was about 2 inches across and 2 inches high. With a Doyen's burr the skull was penetrated at two points: (*a*) The antero-inferior part of wound; (*b*) The postero-inferior part of wound. These two points were joined by making a 'C'-shaped roadway in the bone with the gap of the 'C' below by means of Lane's claw-forceps. When the skull had been completely divided, the bone and soft parts adherent to it (skin, temporal muscle, periosteum) were turned downwards by breaking the bridge of bone at the base. The soft parts acted as a hinge. The dura was now examined, and no abnormality was detected by inspection or palpation.

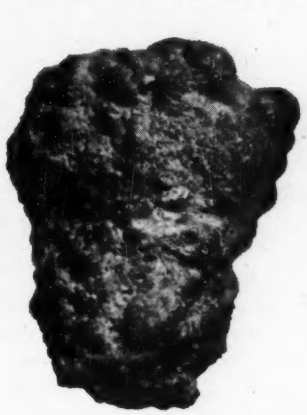

Fig. 470.—Showing the removed calculus (*natural size*).
Greatest length = 1⅝ in.; greatest width = 1⅜ in.; weight of specimen, after excavating for examination, 12·95 grm.

The dura was incised, and no abnormality of the cortex cerebri detected; but on palpating in the postero-inferior angle of the exposed brain a hard mass was felt subcortically. An incision was made over this and the iodized index finger passed in, and a large calculus was removed without difficulty (*Fig.* 470). The lacerated bleeding brain was ligatured and removed around the opening made by the finger and the tumour. The dura was now sutured and the bone-flap replaced. A small glass drainage tube was placed in the wound down to the sutured dura. Michel clips were placed in the skin, and a triangular dressing was applied to the head. The patient bore her operation well, and what little hæmorrhage occurred was easily controlled by forceps and Horsley's wax.

Post-operative Progress.—

July 8, 1911.—There is complete paralysis of the whole of the right side, and rigidity. Babinski, knee-jerk, ankle-clonus, and triceps-jerk are all marked and exaggerated on the right side.

There is complete motor aphasia. The only words articulated being confined to 'no' and 'yes', to such questions as: How are you to-day? An automaton off the big broken lines of transmission of ideas of response.

Vomited twice to-day. The wound was dressed, and two small rubber drainage tubes were put in. The tongue deviates to the right, and the right eye cannot be closed readily.

July 9.—All superficial and deep reflexes very marked. Motor aphasia is still bad, but the patient can articulate a little better to-day. There is right-sided rigidity; but she moved the right leg twice during the night. Slight drooping of the right side of the face, and the tongue deviates to the right. The right pupil is dilated but reacts to the light. Pain and touch are diminished but not absent.

July 10.—Dressed, tubes now removed, and the wound is sealed with bismuth and collodion. Babinski is still marked. Slight dilatation of right pupil persists; but it reacts to light and accommodation. Knee-jerk is exaggerated. Ankle-clonus present. Triceps-jerk is markedly exaggerated. Motor aphasia is much less. Pain and sense of touch are diminished on the right side. Rigidity is passing off the right arm and leg.

July 11.—Patient can now grasp with the right hand, but reflexes are still very exaggerated. Eyes: pupils are quite equal, and react to light and accommodation. No headache.

July 12.—No rigidity to-day. The eyes are equal, and react to light and accommodation. Speech and grasp are both improved. Babinski, ankle-clonus, trunk reflexes, knee-jerk, and supinator-jerk, are present on right side.

July 13.—Much the same as yesterday. Head was dressed. Clips were removed. Anterior three-quarters of the wound quite healed. The two holes which contained the drainage tubes are the only parts of the wound now open. Sealed again with bismuth and collodion, and one layer of gauze.

July 14.—*In statu quo.* Has a bad headache in the frontal region left side.

July 15.—Right side is quite flaccid. All reflexes are exaggerated, and Babinski is very marked. The right side of face is now normal and the tongue does not deviate to the right; pupils are equal.

July 16.—Very slight headache. The patient can move the arm and leg to-day with ease. The power of grasp is returning.

July 17.—Pain and touch sensations are markedly improving, and motor aphasia is passing off.

July 18.—The head wound is quite healed, but patient still complains of headache. Babinski is much less marked than four days ago.

July 19.—The patient has no headache to-day, and moves her arm and leg with ease. Has been having massage for the past five days.

July 20.—The motor aphasia is very much less.

July 22.—Reflexes on the left side are normal; there is still marked exaggeration of all on the right side. Knee-jerk, Babinski, ankle-clonus, triceps, and supinator longus are present on right side. Sensations are much improved. Pain sensation is returning rapidly, motor aphasia improving, agraphia and alexia are complete.

July 25.—Tested patient's power of reading; alexia and agraphia absolute.

July 27.—Patient was *x*-rayed to-day. The radiogram is reproduced (*Fig.* 471). Ocular fundi were examined and both found to be normal. Reflexes on right side are all exaggerated, but motor power is much improved.

July 29.—Stereognostic sense is absent on right side—tested by a matchbox, an egg cup, a reel of cotton, the forefinger, and a lump of sugar, none of which could be distinguished. Kinæsthetic sense was unimpaired; two boxes, one empty, the other full, were distinguished without any trouble.

Oct. 20.—Much improved; patient walks fairly well, but drags her right leg. The reflexes are all right. Stereognostic sense is still absent. Pain, touch, and heat and cold sensations are improved on the right side. Speech is improved. There have been no fits since the operation.

I am greatly indebted to Professor S. G. Shattock, F.R.S., of the Royal College of Surgeons of England, for the following pathological description of the tumour removed:—

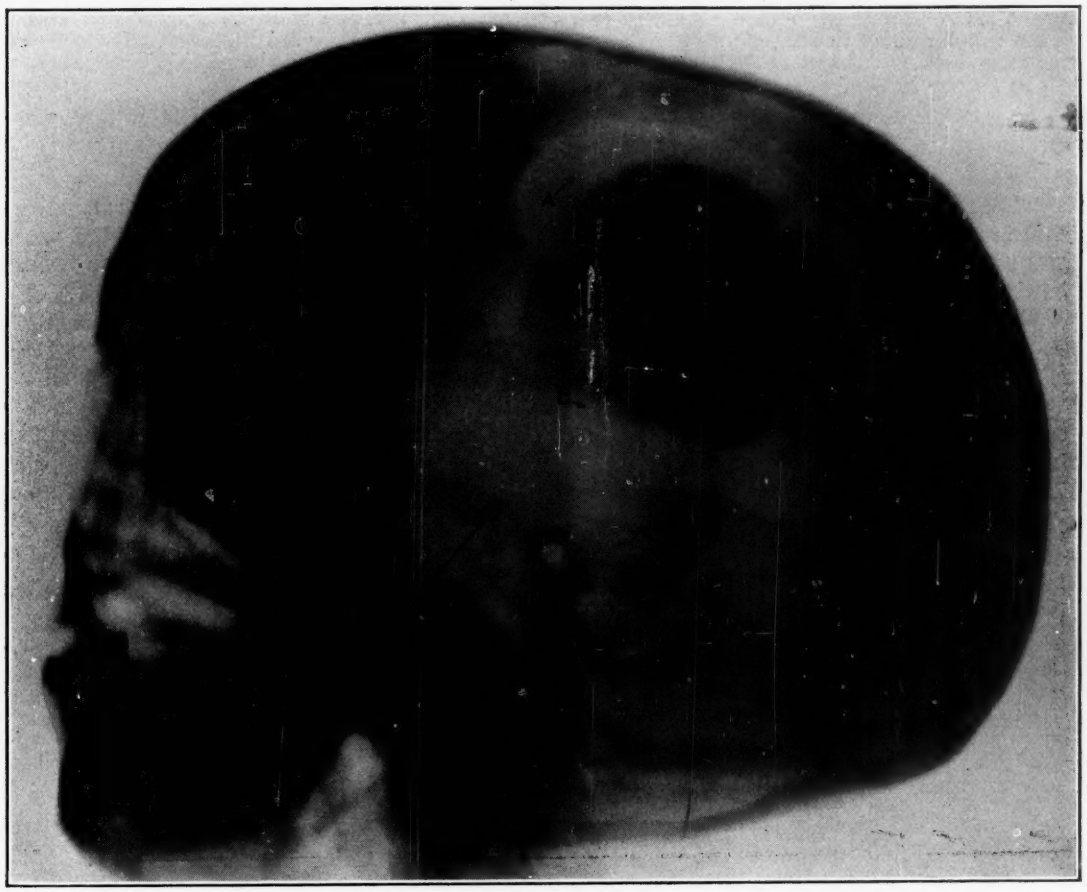

FIG. 471.—Skiagram taken after removal of the brain tumour. A A, The 'C'- shaped roadway made by Lane's claw-forceps; B, The bone-flap; C C, The torn base of the bone-flap; D, Temporomaxillary joint; E, The external meatus.

ST. THOMAS'S MEDICAL SCHOOL, LONDON.
Feb. 27, 1912.

The material is readily crushed into powder, and after treatment with alcohol, and examination in diluted glycerin, the calcareous substance has a distinctly 'fibrous' disposition. On treating the powdered material with hydrochloric acid in microscopical preparations made with water, no evolution of carbonic acid gas occurs, and the 'fibrinous'-looking material is resolved into closely-applied flat cells. The tumour must be classed, therefore, as a calcified endothelioma or perithelioma.

S. G. SHATTOCK.

I am indebted also for a further report by Professor Benjamin Moore, F.R.S., which I obtained through my friend Professor E. Emrys-Roberts, and which is as follows:—

BIO-CHEMICAL DEPARTMENT, UNIVERSITY, LIVERPOOL.,
April 9, 1912.

Report on calculus submitted for examination by Prof. E. Emrys-Roberts.

The percentage composition of the material is as follows: Water 12·8. Organic matter 32·8. Inorganic matter 54·4. The inorganic matter consists, practically exclusively, of calcium phosphate [$Ca_3(PO_4)_2$].

In the organic matter there is a trace of cholesterol, but the other soluble fraction is unweighable, so that the percentage of cholesterol and fats is very small.

The organic matter is highly nitrogenous, containing about 9 per cent of nitrogen (i.e., 3·01 per cent of the entire stone). It contains, however, no uric acid. There is present some material which gives an intense orange colour in carrying out the murexide test. A similar substance I have found lately in the plaques from degenerated arteries, but have not been able to identify; it is not xanthine or any of the known purin bases. The nitrogen content would allow for about 15 to 20 per cent of such a body.

BENJAMIN MOORE.

* * * * * *

There are several points of interest in this case, and perhaps one of the most remarkable is its chronicity, for I heard this year (1921) that Mrs. H. is still alive, and has not had more fits. When I last saw the patient she had athetotic movements of the right hand which she could control with the left, and she was doing her household work.

The *x*-ray photograph was of material advantage in the course of the operation, for on finding the cortex cerebri perfectly healthy, one proceeded with confidence into the interior of the brain in search of the opaque *x*-ray body.

I think for the general surgeon who performs occasional decompression or exploratory intracranial operations, that a Doyen's burr and Lane's forceps take a place in the front rank.

THE USE OF PITUITRIN IN INOPERABLE CANCER.

By J. H. NORGATE, Bristol.

In the wards of a large Poor-law Hospital are always to be found many cases of malignant disease in their later stages. These patients have been seen at other hospitals, possibly been operated upon without success, and eventually drift to their last resting-place labelled as 'inoperable and incurable'.

There are four cardinal points present in these cases: (*a*) Hopeless melancholy; (*b*) Profound cachexia; (*c*) Liability to hæmorrhage; (*d*) Offensive discharges. In the Southmead Infirmary, Bristol, during the past year exactly 100 cases of malignant disease have been recognized; and although it may not always be kind to prolong the lives of such poor sufferers, yet if anything can be done to combat these four points and to give some sort of comfort to the patients in their last days, it is our duty to do it. By letting them drift into the next world with the kindly aid of morphia, we miss the opportunity of studying the disease, and the cure and cause of cancer will never be made plain. The post-mortem findings of a case of cancer are not so interesting as the gradual watching of the progress of the case—which, by the by, is not often seen by the student in the general hospitals of the present day, owing to the hiatus, shall I call it, between the operating theatre and the mortuary.

During a severe outbreak of enteric fever in 1919, finding that pituitrin (posterior infundibular) controlled the hæmorrhage cases without any bad symptoms, I tried it on a case of sudden and severe hæmorrhage from an extensive epithelioma of the tongue with enlarged cervical glands, by injecting 1 c.c. into the tongue muscle.

Case 1.—**Epithelioma of tongue.**

H. M., male. The patient was blanched and apparently choking from hæmorrhage. On injection of pituitrin all bleeding stopped at once, and there was no repetition of it throughout his case; the glands decreased in size; and in a week he could take solid food. I gave him weekly injections into his tongue for three months, and he made rapid improvement, put on flesh, and the cachexia disappeared. He continued nine months in this state; then a hard mass formed in his liver, the growth in the tongue remaining the same, the glands slightly enlarged, and he died very emaciated. The first injection was given on May 12, 1919, and he died on April 27, 1920. His melancholy and suicidal tendencies improved up to about a month before his death.

Case 2.—**Malignant growth of lower jaw.**

J. J. R., male. A railway porter, admitted to the Southmead Infirmary, March 16, 1920. He had been pronounced 'inoperable' at both hospitals in Bristol; sections were taken of the growth. There was a history of illness for eighteen months; a large growth was present underneath the tongue, hiding it from view, starting on the left side of the lower jaw, and forming a huge fungating growth in the neck and indurated 'truffle'-like excrescences in the chin. There had been frequent and very severe hæmorrhages from the mouth, and another occurred in the ambulance on the way to the hospital. He had been fed through the corner of his mouth by a rubber tube fixed on to a feeder. He was very anæmic and emaciated, and there was extreme fœtor, so much so that the other patients made a complaint about it. Two days later I was summoned from a distance to see him, as he was then bleeding furiously from his mouth. I injected 1 c.c. pituitrin into the centre of the growth, and hæmorrhage ceased at once. During twenty-one months he had from one to two injections every week, either into the growth itself or into the chin, but later, when the tumour became too sessile the injection was apt to be wasted, and there was little result. He had only two hæmorrhages, the first when I inadvertently put the needle into the inferior dental artery, the second in the week before he died; in both cases they were at once relieved by an injection. *Fig.* 472 depicts the growth before and after a typical injection of 1 c.c. The patient gained weight, and was able to eat solid food up to a month before he died. The discharge was not at all objectionable, and was of a milky purulent character. His tongue became clearly visible and movable, and the whole growth had gradually shrunk in size,

FIG. 472.—*Case* 2. Before and after injection with 1 c.c. of pituitary gland extract.

leaving a well-marked scar in places where the skin had healed. He had been up, and about the grounds for quite twelve months, and enjoyed life, being very bright, cheerful, and hopeful.

Within a few seconds after the injection—occurring more rapidly in the later ones—he has always become intensely anæmic, with acute pain down his spine—" as if the spine was being crumpled up " ; in a few minutes he was himself again.

The effect on the growth was of great interest, as it could readily be seen on the large surface on his cheek. The colour gradually faded until it was almost paper-white. The whole growth appeared to shrivel, it exuded a milky-white fluid, and remained contracted for about twenty minutes. The growth did not bleed when the circulation was restored. It was interesting to watch the healing process, and to see small fibrous bands forming in the growth and dividing it up into sprouting spaces. As it gradually healed on the left side of the face, it approached the mid-line of the neck.

Two injections a week gave no better reaction than one. The patient appeared to look upon them in the light of a tonic. He developed no more enlarged glands, and no secondary growths elsewhere. During his last month he had great dysphagia and dyspnœa, and the growth had appeared again under his tongue. He died Nov. 12, 1921.

FIG. 473.—*Case* 2. Section of tongue at the edge of new growth.
A, Zone of intense inflammatory reaction at edge of growth. **B**, Growth. **C**, Thrombosed vessel in growth. **D**, Fibrotic tissue replacing tissue of tongue. (× ⅓ obj.).

The post mortem showed no secondary growths in other organs, but the original tumour had extended downwards towards the pharynx and air-passages. The external growth had shrunk from the level of the external meatus to a point 1¾ in. from the lobule of the ear. There was also cirrhosis of the liver (alcoholic), and a cyst of the left kidney. The heart and lungs were quite normal.

PATHOLOGICAL REPORT by Dr. Hadfield, Pathologist to the Bristol General Hospital.

Three pieces of tissue were received for section: (1) *Portion of original tumour* ; (2) *Sessile portion of original tumour ;* (3) *Skin previously affected by new growth.*

Sections of 1 show a projecting mass of completely keratinized squamous epithelium, lying on a thick base of tumour tissue, whose general structure and arrangement is typical of a rather slowly-growing squamous-celled carcinoma, except that practically all the vessels supplying the growth are thrombosed, and their lumina filled by many polymorphonuclear leucocytes. In consequence, in several parts of the growth there are obvious degenerative changes, the most common consisting of focal collections of degenerate tumour cells, containing nuclear fragments, and surrounded by a cell exudate of mononuclear cells and polymorphonuclear leucocytes. The tumour tissue between these foci shows no marked changes (*Fig.* 473).

Sections of 2 show the same essential changes as (1), but cell-nest formation is more perfect, This part of the tumour was originally of slow growth. The keratinized centres of many of the

cell nests are infiltrated by phagocytes, and the growth generally shows much more widespread degeneration.

Sections of 3.—The pathological changes in the sections of the skin previously affected by the new growth are confined to the subcutaneous tissue. The skin is intact, there is no epithelial down-growth; there is a diffuse subcutaneous inflammatory reaction superimposed on a very obvious general fibrosis. This reaction is perivascular in distribution, and a cell exudate surrounds most of the vessels, a few of which are thrombosed. There is no evidence in the section of malignant disease. There are many sebaceous glands which appear normal.

Conclusions.—(1) Both sections of the tumour are typical of squamous-celled carcinoma, with areas of degeneration, due to the thrombosis of the vessels supplying the growth; (2) The degeneration is focal, the tumour tissue between is active; (3) The changes are not typical of infection, but closely resemble those produced by *x* rays.

Out of the 100 cases in the hospital I have injected 36, with varying results; 3 have been successfully operated upon by the surgeon. The seat of injection varies; preferably it should be into the growth itself, especially in the mouth. For bladder, vaginal, and rectal cases it is made into the perineal tissues or the buttocks.

The immediate effects vary. In twenty seconds the patient feels a severe pain either in the back or abdomen, and a sensation of squeezing of the growth. Then follows the intense anæmia, which may be frightening at times, with weakening of the pulse; a little brandy will relieve this at once, but it is better to let the patient feel the full and prolonged effect if possible, as the constriction of the vessels is greater. Some cases have reported a sensation of impending death, and a gradual return to life, but there has been no loss of consciousness.

I have used Ferris and Co. and Parke Davis preparations, and the patient will soon gauge the strength of the preparation by its effects upon him. I find the anæmic cases after severe hæmorrhages present some difficulty; the pituitrin helps them, and if discontinued there is a liability to sudden collapse. The pain has been relieved in many cases; but when the ulceration extends and deep nerves are affected, morphia becomes a necessity—the pituitrin loses its effect. I withhold morphia as long as possible.

I have given 5 c.c. in enteric hæmorrhage in twenty-four hours without ill effect, but have not gone beyond 3 c.c. per week in cancer cases. There has been no death within a week of an injection. It should be given in bed, and a rest of one hour in bed afterwards is advisable. There has been no nausea or vomiting after the injections. An improvement in appetite and gain of weight have been seen in almost every case, and the patients' impression that something is being done for them has dissipated their melancholy; it is not very cheering to be told that nothing more can be done for one.

I have noticed an effect of pituitrin in delaying the onset of secondary glands and growths, also the tendency it has to break down and liquefy the hardened masses, and to render the growths abortive, and I would advise its use after primary operation on a growth to prevent a recurrence in the nearest glands. Secondary deposits in other parts of the body are conspicuous by their absence after pituitrin.

There appears to be a point beyond which it is not advisable to go—the patient can hold no more in his system—especially in aortic disease. I am sure that pituitrin is the most powerful drug we have in use for prevention and stoppage of hæmorrhage in cancer cases: its action is certain, very prompt, and very lasting. The effect on the discharges is various: in some cases it is very deodorant if given into the growth itself, in others not so.

No claim can be made that pituitrin is a cure for cancer, for it only delays the growth by cutting off its blood-supply for a limited time; but as a general tonic to the system, as a great antagonist to cachexia and its attendant distress of mind and body, and as an agent in producing a remission for a time of the 'last sentence' which we know must irrevocably be carried out, its value is great. This prolongation of life for a year or more in patients who might have been expected to live about a month, has been of great interest, and has given me encouragement to hope that further experiments may lead to the unlocking of the hitherto closed door that leads to the cure of cancer.

My thanks are due to Dr. Hadfield for his examination and report of the specimen submitted to him, and to Miss Pillers for her drawings.

FURTHER REPORTS OF CASES.

Case 3.—**Epithelioma of hand.**

J. T., male, age 79. Always refused amputation. Had injections for 5 months. *First injection*, May, 1919. Improvement at first; tumour now growing more vigorously; patient losing weight; no secondary growths in other organs; a few glands in axilla; no hæmorrhage. Injection into wrist.

Case 4.—**Carcinoma of cervix.**

C. R., female, age 83. Cancer affecting vaginal walls; severe hæmorrhage and fœtor. Three injections. *First injection*, June, 1919. Keeping fairly well; no hæmorrhage; rather offensive discharge; losing weight slowly; no cachexia now. Injection into vaginal wall and perineum.

Case 5.—**Carcinoma of rectum.**

J. I., male, age 70. Severe hæmorrhage and fœtor. Three injections into perineum. *First injection*, Sept. 24, 1920. Cachexia gone; up and about all day; huge mass still to be felt in rectum, hollowed out; no hæmorrhage, and little discharge.

Case 6.—**Large growth in right antrum.**

H. J., female, age 75. Growth appears through nose and roof of mouth, growing from a tooth. Tumour known to have existed for 3 months before admission. *First injection*, Oct. 20, 1920. Marked effect and anæmia. Growth halted for 9 months; now growing very slowly; no cachexia; slight hæmorrhage once.

Case 7.—**Carcinoma of labium majus.**

R. B., female, age 70. Inoperable on admission, growing then 6 months. *First injection*, Dec. 1, 1920. Six injections; refused more; still alive; has had no hæmorrhage; fœtor now more marked; gradually tunnelling out the pelvis; general health fair, but anæmic; has morphia at night.

Case 8.—**Carcinoma of rectum.**

H. P., male, age 62. Offensive discharge and slight hæmorrhage; very anæmic on admission. Had four injections into perineum. *First injection*, Oct. 20, 1920. Cachexia now gone; no hæmorrhage; tunnelling of growth now going on; was melancholic, but is now bright.

Case 9.—**Malignant disease of breast.**

C. T., female, age 72. No ulceration; secondary glands neck and chest. *First injection*, Oct., 1920. No progress of tumour; glands much the same; no cachexia; seems in fairly good health.

Case 10.—**Carcinoma of cervix.**

S. D., female, age 43. Severe hæmorrhages and fœtid discharges; losing weight rapidly. *First injection*, Sept., 1921. Comes up fortnightly for injections into perineum; is looking better; has had no more hæmorrhages, and discharge is less offensive; much brighter.

Case 11.—**Epithelioma of tongue.**

S. A., male, age 59. Severe hæmorrhages, always controlled by pituitrin into growth; marked fœtor with emaciation. No real improvement except control of hæmorrhage. Died in five months.

Case 12.—**Carcinoma of breast.**

A. B., female, age 56. Growth 3 months. Secondary glands in axilla. Very obese woman. Also cardiac dilatation and asthma. Admitted Oct. 4. *First injection*, Oct. 10, 1920. After two injections the whole solid mass of breast broke down and discharged, leaving a shell of skin and muscle; no hæmorrhage after, but fœtor very disagreeable. Had four injections. Very delirious and noisy; morphia. Died in Jan., 1921, in a heart attack.

Case 13.—**Carcinoma of breast.**

E. D., female, age 72. Growth 9 months. There is a deep, depressed circular pit over left breast, with hardened edges, exposing the ribs with deep infiltration of the chest. Severe hæmorrhages, controlled with pituitrin into the edges of the crater; marked fœtor and cachexia. *First injection*, Nov. 1, 1920. Improved, and took her food well; glands in axilla disappeared after two injections. Relapsed, and died April 26, 1921.

Case 14.—**Carcinoma uteri.**

M. D., female, age 77. Severe hæmorrhages for 6 months. Admitted, Nov. 13. *First injection*, Nov. 20, 1920. Hæmorrhages controlled by pituitrin, no more occurring; secondary growth in liver; improved a little. Died April 30, 1921.

Case 15.—**Cancer of tonsils and structures near.**

A. D., male, age 58. Admitted Dec. 7, 1920. Many enlarged glands in neck gave him much pain and extreme anæmia; great dysphagia and dyspnœa. Marked melancholia. *First injection*, Dec. 10, 1920. Improved at first; no hæmorrhage at all. Died May 27, 1921.

Case 16.—**Cancer of uterus.**

A. J., female, age 32. Known to exist 1 month. Pelvic glands. Severe hæmorrhages and cachexia. *First injection*, Nov. 5, 1920. Marked effect; no hæmorrhage. Died Jan. 6, 1921.

Case 17.—**Carcinoma of cheek and antrum.**

R. M., male, age 85. Three months' hæmorrhage and extreme fœtor. *First injection*, Oct. 12, 1920. Breaking down of mass and glands, and clearing out of whole of right side of mouth; intense fœtor; no hæmorrhage. Died Jan. 1, 1921.

Case 18.—**Carcinoma of rectum.**

M. Q., female, age 56. Hæmorrhage and cachexia marked. *First injection*, Oct. 20, 1920. Had several injections weekly. Cachexia markedly improved; no hæmorrhage; fœtor bad towards the end. Died June 10, 1921.

Case 19.—**Epithelioma of tongue.**

W. S., male, age 72. Locked mouth and huge growth in neck on right side. *First injection*, Oct. 23, 1920. Two injections liquefied the growth in the neck, and it discharged externally. Unable to be fed by the mouth, which was in a terrible condition. Died of septic pneumonia Nov. 4, 1920.

Case 20.—**Carcinoma of breast.**

D. S., female, age 69. Glands in axilla. Also aortic valvular disease. *First injection*, Dec. 30, 1920. Had little, if any, effect. Died Feb. 16, 1921.

Case 21.—**Carcinoma of breast.**

R. T., female, age 75. Secondary deposits in hip after removal of breast; spontaneous fracture. *First injection*, Dec. 20, 1920. Little, if any, improvement. Early morphia. Melancholia supervened. Died April 30, 1921.

Case 22.—**Carcinoma of neck.**

T. Y., male, age 48. Huge glands; marked cyanosis; mental symptoms; locked mouth. Two injections. No improvement beyond softening of glands, which relieved pressure on his vessels. Removed to insane wards, and died soon after.

Case 23.—**Epithelioma of larynx.**

R. B., male, age 83. Tracheotomy. *First injection*, May 4, 1921. Improved up to a point; appetite better, and much more cheerful; growth spread to the œsophagus; no hæmorrhage. Died Oct. 22, 1921. Growth 8 months.

Case 24.—**Cancer of uterus.**

E. C., female, age 76. Severe hæmorrhage and cachexia. One injection given March 20, 1921, that controlled the hæmorrhage. Made no progress. Died May 9, 1921. Growth 6 months.

Case 25.—**Cancer of left breast.**

A. C., female, age 57. Similar to *Case* 13. Deep pit with raised edges. Admitted July 29, 1921. Severe hæmorrhages at every dressing; marked anæmia and cachexia. *First injection*, Sept. 6, 1921. Glands in axilla disappeared after few injections. Now getting worse, and walls breaking down. Growth 9 months.

Case 26.—**Epithelioma of lower lip and jaw.**

W. D., male, age 74. Fungating mass with glands. Extreme anæmia and cachexia from repeated hæmorrhages. *First injection*, June 20, 1921. No further hæmorrhage, and some improvement. Died in lavatory, Aug. 12, 1921. Growth 9 months.

Case 27.—**Cancer uteri.**

C. L., female, age 56. Very advanced; frequent hæmorrhages. *First injection*, Jan. 5, 1921. No further hæmorrhage, and discharge less fœtid. Died May 4, 1921. Growth 6 months.

Case 28.—**Cancer of neck glands and tongue.**

S. L., male, age 55. Husband of *Case* 27. Fungating mass. *First injection*, May 1, 1921. Softening of glands; no hæmorrhage. Died May 26. Growth 6 months.

Case 29.—**Sarcoma of lower jaw.**

A. D., male, age 48. Enlarged glands; no ulceration. Growing 3 months. *First injection*, June 30, 1921. Three injections produced intense anæmia of growth. Patient went out against medical advice. Growth softening. Mentally strange.

Case 30.—**Epithelioma of antrum.**

W. E. N., male, age 47. Two operations. Fungating mass. Admitted April 30, 1921. Several injections, which relieved pain and size of growth; no hæmorrhage. Morphia. Died Aug. 11, 1921.

Case 31.—**Cancer of rectum.**

W. O., male, age 70. Marked. Nearly moribund on admission. History of repeated hæmorrhages. Anæmia and cachexia very marked. *First injection*, Feb. 1, 1921. Improved very much at first; cachexia disappeared; able to be up and about. Pain returned, and morphia was given. Died Aug. 1, 1921.

Case 32.—**Epithelioma of tonsil.**

E. P., female, age 41. Spreading to tongue. Many glands. *First injection*, April 20, 1921. Improved at first; glands softened and discharged; less dysphagia; no hæmorrhage. Glands appeared on other side; jaundice. Morphia. Died June 18, 1921.

Case 33.—**Epithelioma of palate and tongue.**

S. S., male, age 78. Repeated hæmorrhages, rapidly controlled by pituitrin in mouth, not so quickly when given in arm. Marked anæmia, cachexia, and melancholia. *First injection*, Aug. 1, 1921. Improved and took solid food. Relapsed, and died Nov. 2, 1921.

Case 34.—**Carcinoma of rectum.**

R. W., female, age 79. Growth 9 months. Repeated hæmorrhages. Admitted Jan. 13, 1921. One injection stopped hæmorrhage. Secondary growth in liver. Died June 22, 1921.

Case 35.—**Epithelioma of antrum.**

A. W., female, age 77. Huge fungating mass growing through nose and mouth. Sick 18 months; intensely anæmic, and cachexia marked. *First injection*, April 22, 1921. Improved very much. Had several injections. Died suddenly Aug. 1, 1921.

Case 36.—**Carcinoma uteri.**

E. C., female, age 54. Intense anæmia. Sick 9 months; cachexia and melancholia. Admitted Aug. 31. Had three injections. Improved; no more hæmorrhage. Died Nov. 12, 1921.

Case 37.—**Cancer of tonsil and palate.**

T. C., male, age 72. Admitted Oct. 23, 1920. Had several injections. Glands softened, returned on other side; no hæmorrhages after injections. Died June 20, 1921.

INGUINAL HERNIÆ: THEIR VARIETIES, MODE OF ORIGIN, AND CLASSIFICATION.

By R. HAMILTON RUSSELL, Melbourne, Australia.

PRELIMINARY NOTE ON INFANTILE (OR ENCYSTED) HERNIA.

This subject is more than two centuries old, the first recorded case being that of a French surgeon, Méry, in 1701.[1] It would sometimes happen that in operating for a strangulated hernia the surgeon would find himself unexpectedly in a large serous cavity reaching to the depths of the scrotum in which the naked testis would be seen. Projecting into this cavity would be seen the strangulated hernia in its sac. It would receive the name 'infantile' if the hernia did not project markedly into the cavity; and 'encysted' if it did; and Lockwood was the first to point out that the two varieties were one and the same thing, distinguished only by very superficial and arbitrary points of difference.

Infantile hernia is not really so rare as the small number of recorded cases would seem to suggest. It must be remembered, however, that the older surgeons, whose opportunities for gaining familiarity with hernia were confined to operations for strangulation, were placed at immense disadvantage when confronted with an unusual and mystifying abnormality; their experiences were likely to be unfortunate; their reports of cases correspondingly few; and, it must be confessed, their theories as to its mode of causation amazing.

In 1886, the late C. B. Lockwood communicated the results of an exhaustive study of the subject.[2] He demonstrated a fact that was very helpful indeed, and that badly needed pointing out, namely, that this form of hernia has its origin in none of the strange ways ascribed to it, but that it is a congenital abnormality; he further greatly cleared the air by showing that infantile and encysted hernia are one and the same; and he advanced an elaborate and ingenious theory as to its anatomy and mode of origin. And there, so far as teaching and text-books go, the matter has remained. Lockwood's theory as to the origin and mode of causation of infantile hernia holds its place, apparently unquestioned, in all the text-books of the present day. How astonishing this is will perhaps be realized later; for years ago it was pointed out that:—

1. The improbability of Lockwood's theory is of such a nature that we are bound to regard it, for practical purposes, as impossible.

2. The true explanation of infantile hernia is very simple, and in complete harmony with the anatomy of all the other varieties of inguinal hernia. And then, the crowning revelation might have been added:—

3. If for the sake of argument we were to assume Lockwood's theory to have actually materialized, the resulting hernia would not bear the least resemblance to infantile hernia. (Detailed examination of these three assertions will be found under heading II.)

So long ago as 1907, convinced that Lockwood had in some way been seriously misled, I contributed an article to the *British Medical Journal* on the morbid anatomy and pathology of infantile and encysted hernia, pointing out the virtual impossibility of Lockwood's explanation, while at the same time indicating where, as it seemed to me, he had fallen into error, and offering a simple solution of the problem.[3] I treasure the courteous and appreciative letter I received from him at that time, expressing his renewed interest in the subject, and his desire that he might find time to re-study it in the light of what I had written. That, alas! was never possible.

In my paper I laid stress on the fact that it is not merely a question of what is right or wrong about infantile hernia; the point which is of the first importance is

that, while the acceptance of Lockwood's view sets infantile hernia apart, and renders any sort of relationship between it and other forms of hernia impossible, my view at once establishes the relationship, and makes a logical understanding and classification of all forms of oblique hernia not merely possible but very obvious.

My paper having entirely failed to accomplish its object, I am impelled, having had fourteen years for thinking it over, to restate my position. I propose, however, to handle the matter somewhat differently in the hope of being more convincing. I have treated the subject under three main headings. In (*I*) is given a complete classification of all the varieties of oblique inguinal hernia, showing their serial relationship; (*II*) is devoted to the opposing theories as to the nature of infantile hernia; and, finally, (*III*) deals with direct hernia.

I. OBLIQUE INGUINAL HERNIA.

All varieties of oblique inguinal hernia are determined by developmental variations in the anatomy of the scrotal peritoneum (processus vaginalis).

The scrotum is a specialized structure, virtually a portion of the abdominal cavity, formed for the purpose of giving lodgement to the testis and cord; anatomically it closely follows the main abdominal cavity. The layers of the abdominal wall are all represented in it under the name of 'coverings of the testis and cord'; it is lined by peritoneum, and its contents covered thereby in precisely the same manner as that obtaining in the abdomen. The scrotal peritoneum is called the 'processus vaginalis', and is very simple as compared with the peritoneum of the abdomen, for it has to do with only two organs, the spermatic cord and the testis. That portion of the processus vaginalis which is in relation with the cord will be called in this paper the 'funicular portion' or 'funicular process'; that portion which envelopes the testis (tunica vaginalis testis) will be called always, in this paper, the 'testicular portion'.

About or soon after the time of birth, the funicular portion normally closes, and disappears throughout its entire length from the neighbourhood of the testis to the internal abdominal ring. When this closure is perfect throughout, the individual is safe from the occurrence of oblique inguinal hernia of any kind. But closure is by no means always perfect, and its mere deficiency is the determining factor in the origin of one (*Group A*) of the three groups into which I propose to divide the varieties of oblique inguinal hernia.

The other two groups (*Groups B* and *C*) depend for their main characters upon a different kind of developmental event altogether. The common and distinctive feature of both these groups is the accidental involvement of one or other portion of the processus vaginalis in the abdominal wall during the developmental happenings that eventuate in the formation of the scrotum and its contents. In *Group B* the portion involved is the *funicular portion*; while in *Group C*, round which our interest will be found to centre and culminate, it will be the *testicular portion* which is involved.

Group A.—This group comprises two varieties of hernia only, which owe their origin to the *funicular portion* of the processus vaginalis being (1) totally, or (2) partially unclosed.

1. *Total Failure of Closure.*—The hernia, if there is one, is free to pass into the testicular portion (total funicular hernia). (*Fig.* 474.)

2. *Partial Failure of Closure.*—The hernia, if there is one, will pass as far down the funicular portion as the length of the open tube permits, but cannot pass into the testicular portion (partial funicular hernia). (*Fig.* 475.)

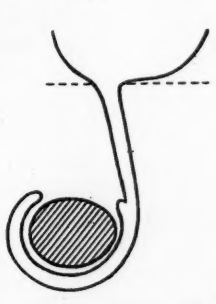

FIG. 474.—Completely open funicular portion.

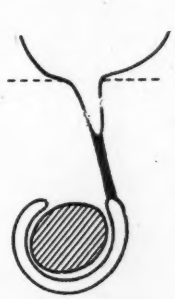

FIG. 475.—Partially closed funicular portion.

[*Note.*—I have suggested the names (1) *total funicular* and (2) *partial funicular* for these two varieties. I hesitate to waste time in pointing out that the old nomenclature

which still seems to maintain a somewhat ambiguous and apologetic hold upon life is simple confusion. Such terms as 'hernia of the acquired type', and 'hernia of congenital type' are the reverse of helpful. Both varieties are equally congenital, and neither is of the 'acquired type', a term which must be reserved for something very different from a partial funicular hernia.]

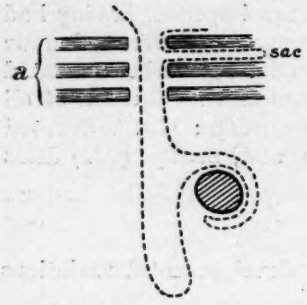

FIG. 476.—Interstitial (intermuscular) sac implication of the funicular portion of the processus vaginalis, with imperfect descent of testis. (*a*) Three layers of abdominal muscles.

Group B.—The characteristic feature of this group of herniæ is a developmental accident that results in the 'catching up' of the *funicular process*, so that it becomes implicated with the developing abdominal wall in such a way that a lateral diverticulum or sac is formed at the spot. Moreover, this 'catching up' of the funicular portion frequently results in interference with the testis also, and that organ is unable to descend freely into the scrotum. Hence the frequent association of these varieties of hernia with imperfect descent of the testis. The relationship between these two events will be readily understood by a reference to *Fig.* 476, in which the thick lines represent the muscular layers of the abdominal wall, and the dotted lines the processus vaginalis. In this figure the sac is intermuscular, and should a hernia pass into it the resulting hernia would be known as 'intermuscular'. But the sac might equally well have been a stratum deeper or a stratum more superficial; it might have lain between the abdominal wall and the peritoneum (properitoneal hernia), or superficial to the abdominal wall altogether (superficial inguinal hernia). To sum up *Group B*, the three members of the group, named properitoneal, intermuscular, and superficial inguinal, depend severally upon involvement of the funicular portion of the processus vaginalis, and they are usually associated with imperfect descent of the testis.

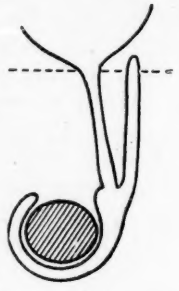

FIG. 477.—'Hernia magna.'

Group C.—This group is formed by developmental accident, identical in nature with the foregoing, but in this case involving the *testicular portion* of the processus vaginalis, with most remarkable results. The descent of the testis is not interfered with, and that being so, it is inevitable that the anchored testicular portion should be drawn out into a long process as shown in *Fig.* 477). In this figure the funicular portion will be seen to be unclosed throughout, while the long process from the testicular portion lies anteriorly and reaches upwards to the abdominal wall.

This being the condition at birth, the subsequent behaviour of the funicular portion as to closure assumes more than ordinary importance. What will it do? It is quite unaffected by the accident that has happened to the testicular portion, and it may pursue any one of the three courses described under *Group I.* Thus.

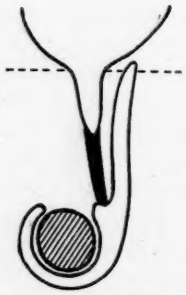

FIG. 478.—Infantile hernia.

1. *The Funicular portion may Close Throughout.*—In this case the individual will have no hernia; but he will have a very large tunica vaginalis which may or may not become evident at some time by becoming the seat of a large hydrocele.

2. *The Funicular portion may Remain Open Throughout*, as in *total funicular* hernia (*Fig.* 477). In this case the individual, if he has a hernia at all, will be afflicted with an enormous one—one of those herniæ that early cause the penis to disappear altogether, and that tend eventually to accommodate a large portion of the intestines (hernia magna).

3. *The Funicular portion may Partially Close*, as in *partial funicular hernia* (*Fig.* 478). In this case the individual, if he has a hernia at all, will have to all appearance an

ordinary moderate or small inguinal one. If he submits to operation, the surgeon will, at the first incision through the skin, open a large serous cavity extending down to the depths of the scrotum, where he will find the naked testis. He will then be wise to cut through the posterior wall of the serous cavity straight on to the sac, which he will find to be in perfectly normal relation to the structures of the cord. He will then complete the operation, which should present no special difficulty in the ordinary way.

FIG. 479.—'Hernia magna' in child. Iodine preparations for operation.

This is what has been known as infantile (or encysted) hernia; it is needless to go into the question as to why it received these names, but anybody who chances upon a case on the operation table, or who studies the small amount of literature there is on the subject, will, I think, very readily satisfy himself that it must be as I have described it.

[*Note.*—I wish specially to call attention to the close relationship existing between the partial and total funicular varieties of *Group A*, and the 'hernia magna' and infantile varieties of *Group C*. It will be noted that the sole point of difference between the two *Groups A* and *C* is in the developmental accident that has distorted the testicular portion of the processus vaginalis seen in *Group C*, and it is this factor alone which converts the ordinary partial funicular hernia into the infantile hernia; and the total funicular hernia into the enormous 'hernia magna'.

The 'enormous' variety of inguinal hernia seems never to have been recognized as a distinct variety, nor to have been accorded a distinctive name. It is, of course, just as distinct a variety as any other, and 'hernia magna' would appear to be the appropriate designation for it. The distinctive feature of 'hernia magna' is the disappearance of the penis in the tumour (*Fig.* 479), leaving merely a round hole on its surface, which is the orifice of the prepuce.]

II. THE CONFLICTING THEORIES AS TO THE ANATOMY AND MODE OF ORIGIN OF INFANTILE AND ENCYSTED HERNIA.

I desire to place the above view as to the origin of infantile hernia side by side with Lockwood's well-known theory, in such a way that the features of both may be clearly seen and contrasted. I have accordingly drawn the two diagrams (*Figs.* 480 and 481) showing the anatomical problem presented by infantile hernia, and indicating the differences of opinion as to the identity of the several parts according to the descriptions of Lockwood and myself respectively.

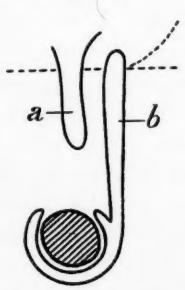

FIG. 480.—LOCKWOOD'S VIEW.
a. The abnormal sac. *b*. Processus vaginalis closed at upper end.

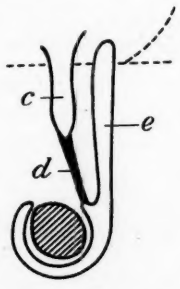

FIG. 481.—AUTHOR'S VIEW.
c. Ordinary funicular sac. *d*. Obliterated portion of funicular process. *e*. Elongated process from tunica vaginalis testis.

Lockwood's theory, it will be remembered, supposes the sac of an infantile hernia to be an abnormal structure drawn down into the scrotum by the tractive power of the gubernaculum testis; and it lies behind the processus vaginalis, which is closed at its upper end only.

Lockwood's View.—1. The processus vaginalis is obliterated high up in the region of the internal ring, but open all the rest of the way down to the tunica vaginalis testis. This, to start with, is an excessively rare occurrence, so rare that I do not think I have ever seen it.

2. The hernial sac is an abnormal one that comes down behind the processus vaginalis. This, again, I have never observed, and if it is possible, it must be excessively rare.

We are thus compelled to assume that two distinct abnormalities, each of them so rare as to be practically unknown, should for some inexplicable reason have a way of occurring together in the same subject with such frequency as to warrant description as a special type of hernia. This is absolutely impossible of belief on the face of it.

The Author's View.—1. The long process of peritoneum in front, finishing in a blind end above, has resulted from the 'catching up' of the testicular portion of the processus vaginalis in the abdominal wall during the descent of the testis, so that it becomes drawn out into a long process by the descent of that organ. Lockwood's error, according to my view, consisted in mistaking this process for the funicular portion of the processus vaginalis.

2. The sac is a perfectly normal funicular sac, quite unaffected by the long process of peritoneum described in *Fig.* 480. That the sac is a perfectly normal one is proved by its normal relation to the cord; this fact alone is fatal to Lockwood's theory. Thus it will be seen that, if my view is to be accepted, we need recognize but one very ordinary abnormality, which is the implication of the testicular portion of the processus vaginalis in the abdominal wall in the course of the developmental happenings that result in the complete descent of the testis into the scrotum.

I have endeavoured to make a fair comparative statement of the conflicting theories of infantile hernia; but there is something further to be said. It appears to me certain that if, in spite of its virtual impossibility, we were to suppose a case brought about according to the accepted theory of Lockwood, the resulting hernia would not even remotely resemble infantile hernia. The reasoning is absurdly simple, and it is concerned with the characteristics of an unclosed funicular process. Every surgeon of experience knows quite well what an open funicular process that has never been occupied by a hernia looks like; he also knows that it is one of the most unobtrusive and evasive little structures in the body, and that in operations on this region (assuming that it is not being specially looked for) he is more likely not to see it than to see it. Now, I ask, can it by any effort of the imagination be supposed that this frail little tube could ever present itself in the guise of a large serous cavity passing down into the depths of the scrotum and occupied by the naked testis? As well mistake a glass marble for a football! Again, let us go a step further and suppose an operation on our hypothetical case; what should we find? We should find a hernia with the structures of the cord lying in front of the sac; nothing more. But the whole discussion is now beside the mark, for there is no reason to suppose that any such case has ever existed.

III. DIRECT INGUINAL HERNIA.

There are two kinds of direct inguinal hernia, one of which is caused by a small congenital sac that usually comes straight through the conjoined tendon to project at the external ring. The other form, which is seen with great frequency, consists of a bulging directly through the posterior wall of the inguinal canal internal to the epigastric vessels. Often it is associated with a small funicular sac, in which case an oblique depression caused by the deep epigastric vessels will divide the tumour into two parts when the patient is examined in the standing position. This form is especially liable to appear for the first time in the later decades of life, and it is caused by congenital weakness of the musculature in the inguinal region. It is the only form of spontaneous hernia to which the term 'hernia of the acquired type' is applicable, for it is the only form of spontaneous hernia that does not enter a sac that is pre-formed. The question arises, Why should the muscles of this region be unduly weak in the case of some individuals? Further, What is the relationship, if any, between this form of hernia and the oblique form?

I venture to advance the following line of reasoning: In oblique inguinal hernia the

failure of the funicular peritoneum to close, in fact all the various developmental accidents that we have been considering, must be regarded as evidence of developmental deficiency. If we now study the phenomena presented by developmental defects elsewhere, we find always that the arresting influence, whatever may be its nature, involves not merely an individual structure, but a region ; and that all the structures of the region are liable to be implicated in varying degrees.

Almost any example will readily illustrate this principle. In the face, for instance, it is not merely that the palate or the lip fails to join up, there will usually be in addition a noticeable arrest of development seen in all the structures of the region ; and their arrest is found to be very variable both in degree and distribution. Sometimes it will involve the bones without any cleft in the palate at all ; while, again, the palate will be cleft, with but little appreciable deficiency in the bones. And similar caprice will be noted elsewhere whether we look to the genito-urinary region or the vertebral canal.

My point is that the muscles of the inguinal region are liable to participate in the same arresting influence that determines non-closure of the funicular peritoneum, but that the two things are not necessarily associated in any individual case. By this I mean that we may have an open funicular peritoneum with perfectly formed muscles ; we may have congenitally weak muscles with a perfectly closed funicular peritoneum ; and we may have them separately or together, in infinitely variable gradations. And just as the hernia resulting from the open funicular process will necessarily be an oblique hernia, so the hernia resulting from muscular weakness will necessarily be a direct hernia. Nor need we wonder that this form of hernia should be peculiar to the inguinal region, and solitary in the body ; for there is no other example in the body of the part played by muscle similar to that played by the 'inguinal sphincter' in the prevention of hernia. Many years ago, when writing upon inguinal hernia, I fell into error by failing to recognize the true relationship between oblique and direct inguinal hernia ; I am glad to have this opportunity of acknowledging and correcting my mistake.

I must, before concluding, allude to what is known as the " Saccular Theory of Hernia ", first published in 1906. As the statement of a great general principle firmly based on truth, it has gained such acceptance as it was bound to ; but I have never been quite satisfied. While the principle has been accepted, it has not appeared to be so helpful in the actual practice of surgery as I hoped it would be. I see now that the principle was not enough ; much more detail was essential, and it was lacking. To tell a student that all spontaneous herniæ depend upon the presence of a pre-formed sac does not help him very much when confronted later with one of the varieties of hernia seen in *Groups B* and *C*. Make him understand that the variety of hernia is determined by the shape of the sac ; show him correctly what the shape of the sac really is, and how it has come about, and you will help him most notably ; for you will have set his feet upon the only path that can lead to intelligent and confident operating.

To supply this deficiency has been one of the objects of this paper, and I have added a 'synopsis' showing the relationship of all the varieties of oblique inguinal hernia, in the hope that it may perhaps be found of service in simplifying for teaching purposes what is, without doubt, a somewhat complex subject.

SYNOPSIS OF THE VARIETIES OF OBLIQUE INGUINAL HERNIA.

GROUP *A*.—The processus vaginalis is normal in shape. The two varieties, (1) Total (*Fig.* 482), and (2) Partial (*Fig.* 483) funicular hernia, are the result of imperfect obliteration of the funicular portion of the processus vaginalis.

GROUP *B*.—The processus vaginalis is distorted by implication of its funicular portion in the abdominal wall, with lateral sacculation and interference with the descent of the testis. Hence arise three varieties of hernia, viz. *Fig.* 485, Properitoneal ; *Fig.* 486, Intermuscular ; and *Fig.* 487, Superficial inguinal.

Group *C*.—The processus vaginalis is distorted by implication of its testicular portion in the abdominal wall, with the result shown in *Figs.* 488, 489, 490. The character

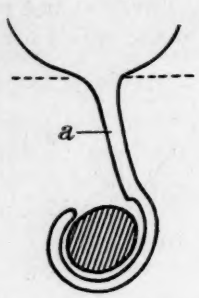

Fig. 482.—Total funicular hernia. *a*. Funicular portion of processus vaginalis.

Fig. 483.—Partial funicular hernia.

Fig. 484.—No hernia.

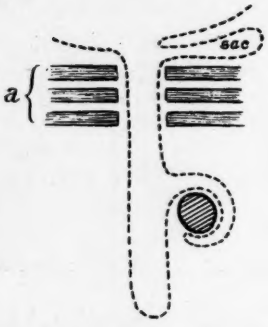

Fig. 485.—Properitoneal hernia. *a*. Three layers of abdominal muscles.

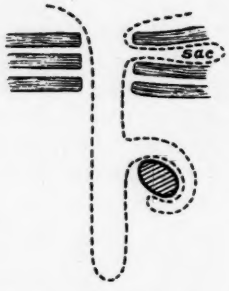

Fig. 486.—Intermuscular hernia.

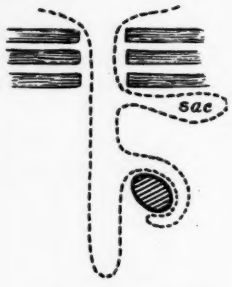

Fig. 487.—Superficial inguinal hernia.

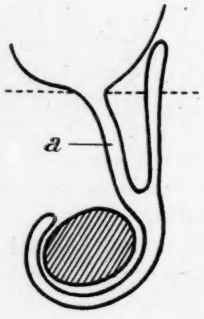

Fig. 488.—Hernia magna. *a*. Completely open funicular portion.

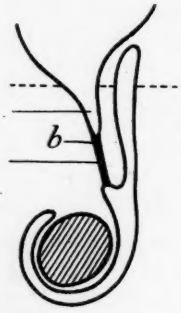

Fig. 489.—Infantile hernia. *b*. Partly closed funicular portion.

Fig. 490.—No hernia, but potential large hydrocele.

of the resulting hernia will then be determined by the behaviour of the funicular portion precisely as in *Group A*.

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[2] *Med. Chir. Trans.*, 1886.
[3] *Brit. Med. Jour.*, 1907, Nov. 16.

HYDRONEPHROSIS.*

By CHARLES A. PANNETT, London.

There is a large group of cases of hydronephrosis in which the dilatation stops short at the ureteropelvic junction, and either there is no obvious obstruction at that point, or the factors which are generally accepted as producing an obstacle to the urinary outflow appear quite insufficient to play the part assigned to them. The existence of these cases has been recognized by many surgeons. Thus Albarran says, " in a large number of cases the orifice of the ureter in the pelvis is cupuliform, normal, or even enlarged ", but he offers no explanation of this anomaly. Braasch again, on page 126 of his book on pyelography, shows the photograph of a hydronephrosis in which he says that no cause was found for the obstruction at operation. My object is to arrive at a truer conception of the genesis of these upper urinary retentions ; to review modern methods of recognizing incipient hydronephrosis—for upon this will, in the main, depend the success of treatment ; and finally to discuss what this treatment should be in the light of the facts brought forward.

The problem may well be defined by describing the salient facts in the clinical aspect of three sufferers from this interesting pathological condition.

Case 1.—A. T., a woman, age 20, had an acute attack of pain in the right loin and then in the right iliac fossa. Vomiting followed, and there was a temperature of 100° and a pulse of 100, with abdominal rigidity on the right side. Cystoscopy showed the ureteric orifice to be normal in appearance ; a specimen of urine from the right kidney was quite clear. Laparotomy was proceeded with ; no intra-abdominal inflammatory lesion was discovered. Right kidney enlarged and situated rather low. During convalescence pyelography was done (*Fig.* 491) and hydronephrosis was revealed. Later, operation by another surgeon. Kidney was exposed. An abnormal artery crossed behind the ureter, but was not convincingly the cause of the obstruction : the part of the pelvis outside the renal sinus was not dilated. Both these findings corroborate the information furnished by the pyelograph, for there is no dilatation immediately above the site of crossing of the abnormal artery, as one would expect in a hydronephrosis of such degree if that had been the cause. The kidney was freely mobile. It was fixed.

FIG. 491.—*Case* 1.

Case 2.—S. W., a woman, age 62. Twenty years ago she had had her right kidney fixed. During the year following this operation a lump appeared, and urine was aspirated from it on three occasions. There had been no trouble since. One year ago she had pain in the left side of the abdomen, and a lump appeared which she noticed to vary in size. She was admitted to St. Mary's Hospital. Clinical diagnosis, hydronephrosis. On cystoscopy and ureteral catheterization to test the function of the right kidney, the bladder and both ureteric orifices appeared normal. Urine of S.G. 1015 was secreted by the right kidney, but the urea percentage was only 1·2, an indication that nephrectomy on the left side was inadvisable. At operation the left kidney was found to be abnormally mobile, the pelvis was of such dimensions that it was eventually plicated. It was opened and a large-sized bougie was found to pass readily from the pelvis down into the ureter and bladder. Nephropexy was performed. Complete relief eight months later.

* Hunterian Lecture delivered at the Royal College of Surgeons Feb. 10, 1922.

Case 3.—E. A., a woman, age 45, for a year had had intermittent pain in the right side of the abdomen. There was tenderness at this point, extending upwards from the right iliac fossa to the right costal margin, and to the loin behind. No tumour could be felt. Pyelogram taken (*Fig.* 492). At operation there was a distinct narrowing at the ureteropelvic junction, which was incised longitudinally and sewn up transversely, followed by a nephropexy. Some leakage from the fourth to the tenth day of convalescence. One year later she was quite well, and had had no further symptoms.

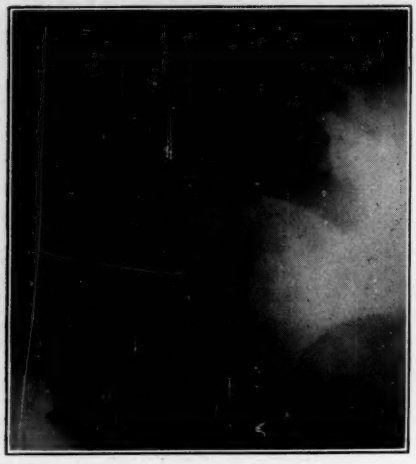


FIG. 492.—*Case* 2.

What is common to these three selected cases, and what impresses itself so forcibly upon an operator who is entrusted with the managem nt of hydronephroses belonging to these groups, is the fact that there is not sufficient mechanical narrowing of the kidney excretory duct to account for urinary retention of such degree. The artery in the first patient had existed in its abnormal position since birth, and the mobility in *Case* 2 was in all probability of long duration. Why, then, if these agents accounted for the hydronephrotic condition, did the lesion not manifest itself until the age of twenty years in *Case* 1, and sixty-two in *Case* 2? The same pertinent question may be asked about the third patient if the narrowing at the uretero-pelvic junction be regarded as a congenital and not as an acquired formation. The answer is to be found in the study of the anatomy and physiology of the pelvis and ureter.

I. ANATOMY AND PHYSIOLOGY OF THE PELVIS AND URETER.

Anatomy.—The anatomy of the kidney pelvis has been studied by Hyrtl, Papin, Legueu, Disse, by dissection, and by taking casts of this structure when distended after death. It has also been investigated by radiography after filling the renal pelvis with an opaque fluid, in excised kidneys, and by pyelography during life. The last method probably gives a truer picture of the shape of the living pelvis, whose muscular walls have a tone of their own, and so influence its conformation; but the method cannot be employed systematically in healthy individuals, and, indeed, we obtain pictures of distended normal living pelves only when a wrong diagnosis has been made and a suspected renal lesion is proved by pyelography to be a lesion of some other organ. But the knowledge thus gained serves to check observations made after death. Typically we may say that, on being traced upwards, the ureter expands into a funnel-shaped structure which soon divides into two segments or primary calices. The upper oblique one carries on the line of the ureter; the lower one branches off more or less horizontally. The oblique calyx is long and thin, often with a constriction in its middle; the horizontal one is short and stumpy. Each primary calyx has opening into it calices of the second order. Branching does not proceed beyond this usually. Sometimes there is a third primary calyx. Really this is an unusually large secondary calyx which opens into the horizontal calyx, occasionally into the bifurcation between the two primary calices, or, exceptionally, into the upper calyx.

FIG. 493.—Normal type.

The arrangement and form of the pelvis and calices, however, shows a very wide range of variation from the standard type which is shown in *Fig.* 493. Thus the pelvis may be very small, the ureter appearing to split almost directly into two primary calices

(*Fig.* 494). In other cases the pelvis is large and the calices are sessile in their insertion (*Fig.* 495). An ampullary form of pelvis is described (Braasch, Papin). If such a variety is truly normal, it is very difficult to distinguish it from the early stage of hydronephrosis. This aspect of the anatomy of the renal pelvis will be returned to again when the diagnosis of pelvic abnormalities is considered.

The ureter is not of uniform calibre along its length: there are three narrowed areas, between which are two fusiform segments called the lumbar and pelvic ureteric spindles. The lowest constriction is at the vesical orifice, the middle one at the point where the ureter crosses the iliac vessels. The uppermost narrowing is variable in position: sometimes it is situated at the junction of the pelvis and ureter, but in other individuals it lies four or more centimetres below the upper end of the ureter, which is funnel-shaped, but yet quite distinct from the renal pelvis (*Fig.* 493). A fourth constriction has been described as present in some women where the uterine artery crosses the ureter. These narrowings of the ureter are not present in quadrupeds, but appear in the orthograde apes.

FIG. 494.—Normal pelvis: bifid type.

FIG. 495.—Normal pelvis with sessile calices.

The descriptions of the structure of the wall of the ureter vary very much, and there is scarcely any reference to the structure of the pelvic wall. Thus, Kölliker describes an external longitudinal coat and an internal circular coat in the upper two-thirds of the ureter; in the lower one-third another longitudinal coat internal to the circular one. Henle describes an outer circular, and an internal longitudinal, layer. Disse maintains there are three coats all along, two longitudinal layers with a circular one between them.

My own investigations agree with the description of Böhm, Davidoff, and Huber. In the middle and upper regions of the ureter there is a thick longitudinal layer with a thin external circular layer. In the lower one-third another and much less uniform longitudinal layer appears outside the circular layer. This is the structure in the adult. Immediately after birth, sections show that the muscular fibres are arranged chiefly concentrically, with the lumen of the ureter: only a few longitudinal bundles are seen. Serial sections have demonstrated that these longitudinally-running bundles are circular ones which have bent in towards the lumen and turned either upwards or downwards. The muscular layers are not nearly so regular in the direction of their fibres, nor so distinct from one another, as in the alimentary canal.

The muscular wall of the pelvis of the kidney is thinner than that of the ureter, and the bundles of fibres interlace in all directions. There is no demonstrable anatomic sphincter at the junction of the pelvis with the ureter.

The nerves for the pelvis and upper ureter come from the spermatic plexus; those for the lower ureter from the hypogastric plexus. They are all non-medullated. A plexus is formed under the outer fibrous tunic, but ganglion cells are only found at the two extremities of the duct. From the plexus fibres go to the muscular coat and the mucosa.

Physiology.—The ureter is not a passive channel conveying urine from the kidney towards the bladder. It has an activity of its own, forcing the urine along by peristaltic contractions, not continuously, but intermittently and with a rhythm more or less constant. This muscular contraction was first studied by Englemann in rabbits, cats, and dogs, in 1869, and although many others have also investigated it, the physiological mechanism is still far from clear. A rather pretty demonstration of ureteric peristalsis can be given by inserting a long needle from the skin surface through the convex border of the kidney into the pelvis of an anæsthetized rabbit (urethane), and injecting 13 per cent sodium iodide whilst the animal is observed under the *x* rays. The opaque fluid is seen to fill out the pelvis and to be passed by vigorous waves down the ureter.

The method of excitation and the factors influencing ureteric activity remain in doubt, because experiments have given such equivocal, and sometimes opposite, results in the hands of different observers. Certainly the frequency of contractions of the ureter has no very close relation with the volume of urine secreted in a given time. This can be established by simple inspection in cases of exstrophy of the bladder. The jet of urine is more or less abundant according to circumstances. There is a certain increase in the frequency of expulsion when the secretion of urine is more profuse; but the rate of contraction is not to be hurried beyond a certain point. As Englemann showed, there is a refractory period to stimulation. In the normal bladder it is found by observation with the cystoscope that peristaltic contractions take place at somewhat irregular intervals. About twenty seconds is a very usual period to elapse between two ureteric discharges; but often there will be a long pause of several minutes; or again, the ejaculation of urine may take place five times in a minute. These variations seem to depend upon nervous reflexes, powerful amongst which are those set up by the necessary instrumentation. The rhythmical power of contraction appears to be a property inherent in the ureter just as it is in the heart, and, like this organ, it is not necessary that fluid should be propelled in order that contractions may take place; for if the pelvis of the kidney be severed from the ureter experimentally, peristalsis continues to take place in this latter structure unaltered. Moreover, I have observed by cystoscopy the vesical portion of the ureter to contract months after a nephrectomy had been performed. This innate tendency to rhythmical muscular contraction is exhibited well by excised ring preparations of ureteric segments in Locke's solution. D. I. Macht, in particular, has investigated the properties of ureteric muscle in animals and man by this method. He found that ureteric muscle contracts better if a little urine is added to the Locke's solution or if the solution is slightly acid. I cannot agree with him that this approaches the conditions existing in the body. The muscular wall of the ureter is never bathed during life by urine or an acid fluid. These two factors can only act through the medium of nerves in the mucous membrane. Macht also showed that epinephrin stimulates ureteric peristalsis in the pig's ureter, and, if in sufficient concentration, causes it to go into tetanic spasm.

Fig. 496 is a tracing obtained from two rings of muscle, one from above the ureteropelvic junction, and one from the ureter just below, cut from the excised kidney of a man. Simple Locke's solution, oxygenated, and at body temperature, was used. After one hour and a quarter the ureteric ring began to contract spontaneously, two contractions at a time, at long intervals. But the addition of adrenalin caused regular and more frequent contractions to take place until, apparently, the muscle was exhausted. There was no tendency to tetanus. The lower tracing is from the pelvis. No spontaneous contractions occurred in this, but adrenalin acted as a stimulus, and there was regular movement of the lever. These contractions took place at a rate nearly twice that of the ureter. It is clear that the pelvis has an innate tendency to rhythmic contractions just as has the ureter, and it is equally interesting that a normal constituent of the blood (epinephrin) acts as an excitant of ureteric contraction.

Whilst peristalsis of the ureter appears to arise in this structure itself, it is very much under the influence of extrinsic nervous impulses. Opening the abdomen seems to inhibit peristalsis of the ureter just as it does of the intestinal wall, and no cystoscopist can doubt

the influence of his manipulations upon ureteric activity. Section of the splanchnics in my hands has given conflicting results, no doubt because the experiment, owing to the operation of factors unknown, could not be reduced to its simplest terms.

Protopopow found that stimulation of the peripheral end of the splanchnics led to acceleration and strengthening of contractions, whilst Stern sometimes got augmentation, but usually inhibition. Probably there are both kinds of nerve fibres running in the splanchnics.

Dissimilar Functions of the Renal Pelvis and Ureter.—A very cursory consideration of the salient facts of renal secretion and discharge leads us to the conclusion that these two divisions of the kidney duct are separate functional entities. That the passage of urine down the renal tubules into the pelvis is continuous is a simple fact of physiology; that the passage of urine from the ureter into the bladder is an intermittent process is an every-day cystoscopic observation. How is it that a continuous trickle into one end of the duct becomes an interrupted efflux from the other? The explanation resides in the fact that the pelvis acts as a temporary reservoir for the secreted urine, being separated

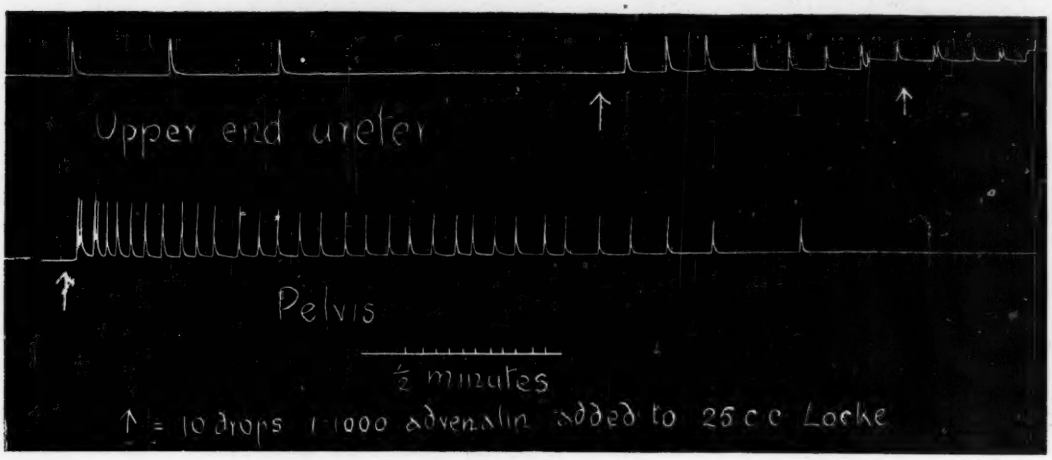


FIG. 496.

from the ureter by muscular contraction at the ureteropelvic junction. At certain intervals the pelvis contracts, and with this contraction there is a relaxation at the ureteropelvic junction; urine passes into the ureter and is carried onwards by a true peristaltic wave.

Confirmatory evidence has been sought to test the truth of this conception of a ureteropelvic sphincter. A rabbit was anæsthetized with chloral and the ureters were exposed by a median laparotomy. Peristalsis was observed taking place in each of them. The bladder having been opened, a small glass cannula was introduced into the left ureter and Locke's solution allowed to trickle in under low hydrostatic pressure. The ureter was seen to dilate gradually, and peristalsis to weaken. Finally, the dilated ureter ceased to contract at all, but the dilatation stopped at the ureteropelvic junction.

I have also obtained evidence of a local sphincteric action at this point by inserting a fine cannula through the convex border of the kidney into the pelvis. In one experiment the pelvis distended without the ureter; in others, over-distention of pelvis and ureter was followed by a localized spasm at the uretero-pelvic junction.*

John Caulk has recently described a case of hydro-ureter due to constriction of the ureter close to the bladder. The ureter was enormously dilated: it measured one and a half inches in diameter from the bladder to the kidney pelvis, and contained eight

* Certain factors, the nature of which I have been unable to determine, sometimes interfere with this reaction. It is easier to elicit the spasm by distension from above than by injection from below.

ounces of urine. Pyelograms showed that there was not the slightest dilatation of the renal pelvis. After incision of its vesical orifice, the ureter returned to its proper calibre and exhibited normal peristalsis. This is a pretty demonstration of a ureteropelvic sphincter—though not recognized as such by Caulk. The pyelogram (*Fig.* 497) I think also tends to support this view. The catheter discharging opaque fluid into the ureter has distended the upper segment of this channel and passed thence through the ureteric sphincter, spasmodically contracted round a stone, into the renal pelvis. At operation the ureteric wall at the site of impaction of the calculus was unaltered, apparently, and the fact that urine could escape and the opaque fluid gain entrance past the stone, shows that the constriction seen in the pyelogram is spasmodic in nature.

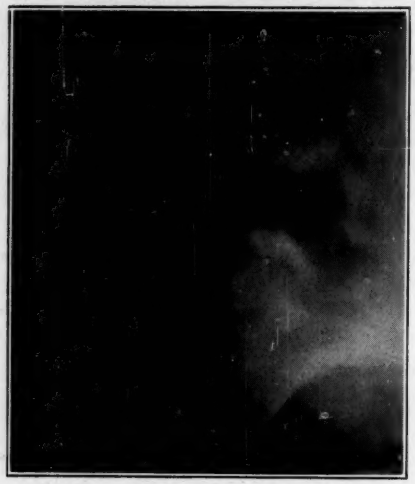


FIG. 497.—Showing spasm round a stone at the uretero-pelvic junction.

That there are such cases of hydronephrosis as that cited at the beginning of this thesis, where at operation a fair-sized bougie would pass easily down to the bladder, the pelvis of the kidney alone being distended, is evidence of a distinction of function between the two segments of the kidney duct.

II. THE BEARING OF THE FOREGOING DATA UPON THE CONCEPTION OF THE GENESIS OF HYDRONEPHROSIS.

If we keep in mind the physiological mechanism by which urine is transferred from the kidney to the bladder, we shall be able to realize how disturbances of this mechanism, or of its relation to renal function, may throw such a strain upon the renal pelvis that dilatation will result. Let us suppose that a continued polyuria takes place, so that, during a given time, urine flows into the pelvis in quantity beyond the normal limits. Remembering that this structure tends to contract at definite intervals ; that its rhythm is not to be hurried beyond a certain point, being largely independent of the tension of its walls ; and that it is functionally separated from the ureter by a sphincter ; it can readily be seen that the pelvis may be unable to transfer to the ureter as much urine as flows into it from the kidney. It must, then, perforce dilate. Dilatation from over-distention would take place more easily in the pelvis than in the ureter because of its thinner muscular walls. This is no mere hypothesis without foundation. Hydronephrosis without demonstrable mechanical obstruction is well known to occur in diabetes, and Thomson Walker has observed that the attacks of pain in primary hydronephrosis, which are due to a rapid temporary distention of the renal pelvis, are likely to occur after large quantities of fluid have been imbibed. But polyuria itself and unaided is probably a rare cause of hydronephrosis. An abetting cause is some obstruction at the ureteropelvic junction. The alleged causes of such hindrance at the pelvic outlet are impacted calculus, a congenital valve, kinking, stricture, and an abnormal renal artery. To these I would add spasm ; whether this is due to irritation of the kidney or pelvic wall—perhaps by some change in the composition of the urine—or to an extrinsic nervous reflex, I am unable to say.

The Dietl's crises of the dropped kidney or the strictured ureter can be explained in their intermittency by the two contributory causes, polyuria and ureteropelvic sphincteric spasm, acting either alone or in combination. That the obscure cases of hydronephrosis without mechanical narrowing have a similar origin would now seem to be clear and their genesis understandable.

Abnormal Narrowing at the Ureteropelvic Junction as a Cause of Hydronephrosis.—Amongst the cases met with clinically, this is the commonest cause of

obstruction at the upper extremity of the ureter. The hydronephrosis due to it rarely comes on until adult life is reached. This fact has been regarded as a difficulty in accepting the stricture as having a developmental origin, as being an exaggeration of that local failure to increase in calibre which is a normal phenomenon of ureteric growth. Geraghty and Frontz maintain that there are always to be found signs of an old inflammatory process in the ureteric wall if a careful examination is made. I cannot agree with this statement. Sections were made by Dr. E. H. Kettle of the strictured part of the ureter in a specimen of a large hydronephrosis which I removed. He reported that there were no histological signs of the fibrosis of repair in the ureteric wall. I have cut another specimen: it also fails to show evidence of a previous inflammatory process. It seems more correct to regard these strictures as developmental and not inflammatory, and this conclusion is more easy of acceptance in the light of the facts brought forward above, whereby it can be understood how the resulting hydronephrosis need not appear until late in life.

Hydronephrosis due to an Abnormal Renal Vessel.—I believe that the abnormal renal artery going to the lower pole of the kidney plays such a subordinate part in the production of hydronephrosis that it is doubtful whether it should be included in the list of causes of this condition. This vessel may run in front or behind the ureter, which may be found to be kinked over the vessel when the uronephrosis is exposed at operation. At a first glance it is tempting to suppose that the artery is the cause of the obstruction. A closer inspection frequently reveals the fact that the part of the ureter proximal to the kink is no more dilated than that part distal to it. This was so in the patient whose pyelogram is depicted in *Fig.* 504. The abnormal artery and vein formed a very dense cord across the front of the ureter, which ran upwards from its origin to loop over them. The ascending part was adherent to the dilated pelvis. When these adhesions were divided and the ureter was straightened out, the real obstruction was seen to be a narrowing at the ureteropelvic junction. The state of affairs was almost exactly that seen in *Fig.* 498, which is from a specimen in the St. Mary's Hospital museum. In such patients obviously the uronephrosis forms first, and the distended pelvis enlarging downwards carries the commencement of the ureter with it, thus bringing about the kinking over the abnormal vessels. The adhesions are secondary.

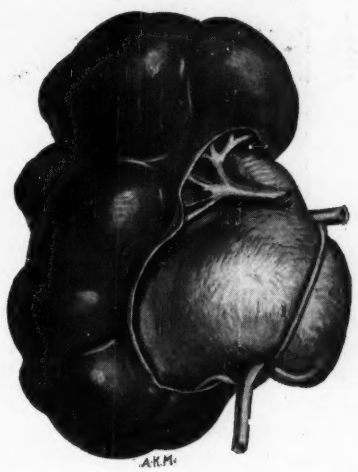


FIG. 498.

The Congenital Valve as a Cause of Hydronephrosis.—The frequency of this fold at the upper ureteric aperture has been over-estimated. Probably it is a very rare cause of hydronephrosis, and I have been unable to find a specimen of it. It must not be confused with the secondary valve, the result of the hydronephrosis itself. Once formed, the latter is a great obstructing factor; but it is not the originator of the hydronephrosis.

Nephroptosis as a Cause of Hydronephrosis.—A movable kidney is not uncommonly associated with hydronephrosis, and in pyelograms the upper end of the ureter is usually found to be curved. A double bend is most characteristic. These kinks are commonly supposed to be the cause of the hydronephrosis, but the pathology is not so simple as this. In the first place the kinks are not sufficiently acute. A very sharp bend is necessary to obstruct a muscular tube such as the ureter; for though there may be some resistance due to the kink, when a peristaltic wave forces fluid along it there is a tendency for the ureter to be straightened out, just as a bent rubber tube uncurls with the forcible passage of water through it. Should the bend in the ureter be fixed by adhesions, this facilitation by straightening cannot take place. Such kinks are found,

but not very commonly. An approximation to this condition, however, probably occurs in the movable kidney. The partial obliteration of a kink at the ureteropelvic junction might only be possible by a slight elevation of the dropped kidney, for which the propulsive force of the pelvic contraction is ludicrously inadequate. The kink is potentially fixed by the weight of the kidney. But admitting such an etiology, there are still a number of cases to be accounted for in which the bends are not acute enough to cause obstruction. In these I suggest there is a spasm at the ureteropelvic junction set up reflexly by a dragging on the renal plexus. On this hypothesis the conditions found in *Case* 2, cited above, and the resulting cure by operation, can be explained. The pyelogram of a similar case in a girl, age 24, is shown in *Fig.* 499.

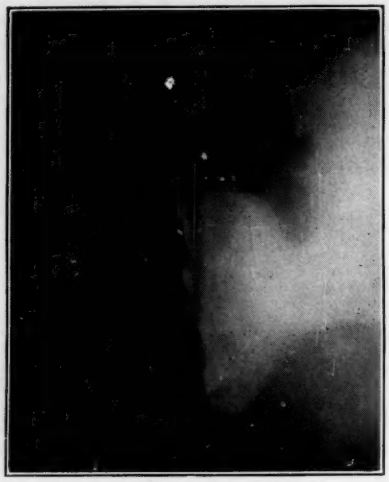


FIG. 499.—Obstruction caused by spasm at ureteropelvic junction in an abnormally movable kidney.

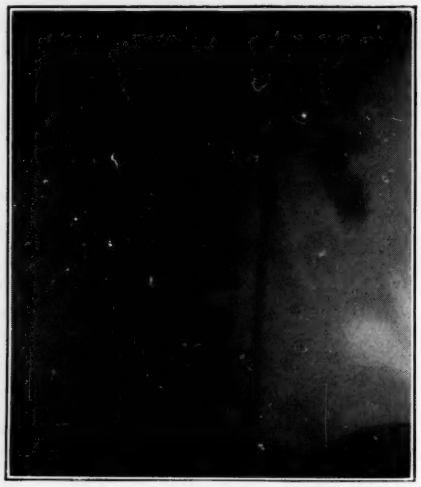


FIG. 500.—Obstruction caused by impacted stone.

Impacted Calculus as a Cause of Hydronephrosis.—This is a very common cause, the stone becoming lodged in the naturally narrow ureteropelvic junction. The intermittent obstruction necessary for the production of the uronephrosis is due to a variation in the spasm of the ureteric wall at the site of impaction which I have shown takes place under these circumstances (*Figs.* 497 and 500).

Other Causes of Hydronephrosis at the Ureteropelvic Junction.—A calculus after lodging at this point may pass, leaving behind it an ulcer which, cicatrizing, produces an inflammatory fibrous stricture. Hydronephrosis will result. A periureteritis may infiltrate the wall of the ureter, rendering it rigid, or actually narrowing it, in both cases causing an obstruction. A very unusual state of affairs was that in a man admitted to St. Mary's Hospital last year with a large swelling in the left side of his abdomen. At the operation a hypernephroma was found in the left kidney. The large hydronephrosis was due to the growth plugging the ureter.

III. THE CLINICAL FEATURES OF EARLY HYDRONEPHROSIS.

Characteristically, in early stages, hydronephrosis is accompanied by attacks of pain which correspond to the periods of greater distention. The pain is acute and is often referred first to the iliac fossa. Nearly always it is felt also in the loin; much less often it radiates to the outer side of the thigh or genitals. Vomiting occurs after the onset of the pain. The pulse and temperature may be raised. There may be superficial tenderness in the iliac fossa, but deep tenderness is found in the renal angle behind and under the costal margin in front, unless the kidney is situated lower. A tumour is by no means always to be felt, as it is often under the ribs and inaccessible, at or the time of the

examination the hydronephrosis may be empty and the sac collapsed. The urinary signs are very inconstant and very often lacking. They are frequency with scanty urine during the attack, and a polyuria afterwards. As a rule these attacks are not accompanied by renal hæmorrhage and there is no alteration in the urine.

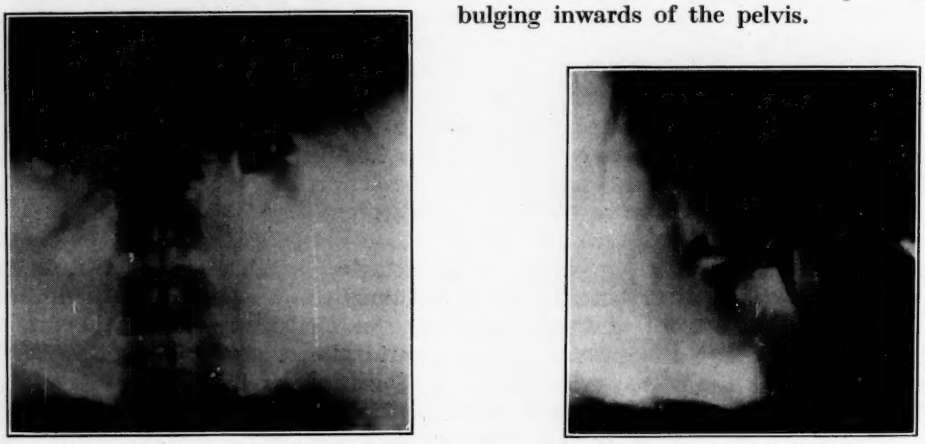
A rare first symptom is hæmaturia. A lady, age 48, had for some months complained of pain in the left side of the back and abdomen. The pain was not acute nor in attacks. One day she passed a large quantity of blood in the urine without pain. A skiagram did not reveal a stone. There was no tumour to be felt in the abdomen when I cystoscoped her a few days later, and the bladder and ureteric orifices were normal in appearance, the effluces being quite clear. A few weeks later another profuse hæmaturia occurred, and it was only with much irrigation that a view of the interior of the bladder could be obtained: the hæmorrhage was then seen to be pouring out of the left ureteric orifice. A diagnosis of renal growth was made, but at the operation the kidney was discovered to be simply a collapsed flaccid hydronephrosis. The cause of the hydronephrosis was a narrowing at the ureteropelvic junction, but the aperture was not of very narrow calibre and was freely permeable.

IV. THE DIAGNOSIS OF EARLY HYDRONEPHROSIS.

The symptoms described, apart from the presence of a renal tumour, will justify the surgeon in doing no more than suspect the presence of early renal retention. Confirmation can be obtained only by cystoscopy and pyelography. On cystoscopy the bladder usually has a normal appearance. Fenwick described a lengthening of the ureteric slit on the side of the hydronephrosis, but this is not a sign upon the absence of which any reliance can be placed. The ureteric orifice may appear absolutely normal. There may be no efflux at all if the hydronephrosis is closed; but frequently the ureter is seen to be discharging in the usual fashion, especially in the intermittent cases. A catheter should be passed up the ureter. This instrument may be arrested at the site of the obstruction, but this is by no means always the case. Very often it will be possible to penetrate through the narrowed portion to the pelvis. Care must be taken not to diagnose a stricture of the ureter at a site where no pathological constriction exists. In women especially, the point of the catheter is apt to be brought to a standstill at the level of the iliac vessels, and less often at the point where the uterine artery crosses the ureter. A smaller-sized catheter (No. 5 instead of No. 6) will almost always get through. When the catheter reaches the pelvis, urine flows out in continuous drops, and a large quantity is collected in a short time. This will almost suffice to complete the diagnosis. There is one other sign. When the pelvis is empty, saline may be allowed to run in: a large quantity can be instilled into the pelvis before the conscious patient will complain of pain. But this is no reliable measure of the capacity of the renal pelvis, for the fluid can escape easily beside the small-sized catheter into the bladder. When the pelvis is not dilated the tension in it soon rises, so that pain is quickly complained of. A pelvis which has been repeatedly stretched by attacks of retention can be distended without pain to a degree far greater than a normal pelvis will tolerate. Pyelography, however, gives the best information as to the size and conformation of the pelvis. In studying the radiographs it is very necessary to have a mental picture of the various forms which the normal pelvis assumes, and again it is essential to know what constitutes a deviation from the normal. When the distention is of moderate or great degree there can be no hesitation in coming to a conclusion that the condition is pathological; but in early cases it is not always easy to decide. Three deviations from the normal shadow have been emphasized as characteristic of early hydronephrosis. They are: (1) Broadening of the bases of the larger calices; (2) Clubbing of the extremities of the calices; and (3) Sagging of the lower border of the pelvis.

The broadening of the necks of the calices (*see Fig.* 506) is a reliable sign, but considerable dilatation can take place without its being present, as can be seen by reference to *Fig.* 500. This shadow is very characteristic of a certain form of hydronephrosis in which

the brunt of the back-pressure seems to fall upon the calices, the pelvis retaining its normal shape and size. In the unaltered kidney the extremities of the shadows of the calices present an indentation due to the projections of the apices of the pyramids. In hydronephrosis the pyramids become flattened, and, in consequence, the corresponding indentations in the calical shadows disappear. *Fig.* 491 is a good example. But too much stress has been laid upon this sign as indicative of early hydronephrosis. One has only to to examine kidneys removed post mortem where there is evident hydronephrosis, to be convinced that the obliteration of the projections of the apices of the pyramids into the terminal calices is not an early sign. A glance at *Fig.* 506 will also show that this is so. The sagging of the lower border of the pelvic outline is seen in *Figs.* 504 and 506. But, again, this is not present in the large hydronephrosis in *Fig.* 491 nor in *Fig.* 492. I should like to call attention to another deviation in the outline of the pelvic shadow which I think is never seen in the normal. It is a bulging of the inner side of the pelvis towards the spine, beginning at the upper end of the ureter. With the inner border of the pelvis the emerging ureter forms an angle open towards the spine. A normal pelvic shadow on its inner border runs directly into the ureter almost in a straight line (*Fig.* 495), or makes an angle in the opposite direction (*Figs.* 493 and 494). This bulging of the inner wall of the pelvis with an angle open towards the spine is seen in *Figs.* 506, 492, 497, and 504. It is a valuable and reliable sign. It is also, I think, what those writers mean who talk about an alteration in the angle of insertion of the ureter. It is not the ureter that is at fault, but a pathological bulging inwards of the pelvis.



FIGS. 501, 502.—To illustrate the difficulty in reading pyelograms.

I should like now to direct attention to *Figs.* 501 and 502, because they demonstrate well the difficulty in interpreting pyelograms. In *Fig.* 501 it will be seen that there is the bulge towards the spine beginning, and a certain broadening of the bases of the calices. Is this an early case of hydronephrosis? Many authorities might regard this shadow as not transgressing the normal limits, but I am not so certain of this. The patient had had attacks of right-sided pain which were supposed to be appendicular. I did not think the pyelograph justified cutting down on the kidney. A surgeon operated and removed an appendix which showed no trace of disease inside or out. No other abnormality in the abdomen or pelvis was discovered. *Fig.* 502 is a shadow in a woman who had repeated attacks of pain in the back and left side. The necks of the calices are still narrow, but there is an absence of indentations into the calices, and the upper group turned forwards (or backwards) seem to form a larger shadow than should normally be there. The lower border of the pelvic shadow shows the beginning of sagging. Here again I was uncertain, and decided against exploratory operation. I hope to follow the further history of these two patients.

As in other instrumental aids to diagnosis, when considering the pyelogram, and

judging whether or not the shadow is pathological in shape, due weight must be given to the clinical history. The pelvis is variable in outline within considerable limits; and it is not always easy for the radiographer to say when these boundaries have been transgressed. Under such circumstances a careful review of the symptoms must be made. These, if ambiguous, will point to the necessity of later study of the case in the event of their recurrence, but if distinctive will confirm the suspicions aroused by the radiogram.

Difficulty in diagnosis of early hydronephrosis is most likely to occur when it is the right kidney which is affected, for in this case it must be distinguished from appendicitis, cholecystitis, and torsion of a mobile cæcum. A careful consideration of the history of the attacks will lead the surgeon to suspect one or other condition; but if consulted between attacks, physical signs may be absolutely lacking in an ordinary clinical examination. Particularly confusing is the story of attacks of torsion of a prolapsed mobile cæcum, for there is a history of a lump appearing in the abdomen which goes with the cessation of the pain. This tumour, however, is lower than the usual kidney swelling. There is no pain in the back. If seen during the attack the nature of the swelling is evident: it is tense, resonant, and perhaps varies in hardness with peristaltic contractions of the cæcal wall.

The Technique of Pyelography.

The obtaining of successful pyelograms requires meticulous care in following out the details of a rather complicated technique. The patient, radiologist, and surgeon must all co-operate. Several questions have to be decided. They are: (1) The choice of the solution for injection; (2) The p essure under which this solution should be injected; (3) The anæsthetic to be used; (4) The position of the patient; and (5) The radiographic technique.

In the past, a number of different substances have been used for injection—argyrol, collargol, cargentos, silver iodide, and thorium nitrate. I have used and obtained good shadows with argyrol, collargol, and thorium citrate. Of these, Braasch's researches have shown thorium citrate solution to be the least harmful to the kidney substance, but the shadows with it are not quite so good as with silver salts, and it is rather troublesome to prepare. Fortunately, solutions of both sodium iodide and bromide are innocuous and give excellent shadows. The careful work of Cameron has shown that a molar solution of sodium iodide (13·5 per cent), a $\frac{5}{10}$ molar solution of thorium citrate (15 per cent), and a 3-molar solution of sodium bromide (25·2 per cent) have the same opacity to x rays. The harmlessness of sodium iodide or bromide solutions was demonstrated by retaining them in the kidney pelves of dogs at kidney secretory pressure for twenty-five minutes: afterwards no alteration in the blood urea and nitrogen estimations was found, and phenolsulphonephthalein was excreted in normal fashion. Again, intravenous injections of large doses of sodium bromide or iodide produced no effects. Potassium bromide or iodide, however, is very toxic on injection. The viscosity of the sodium iodide solution is less than that of the other two solutions, and its osmotic pressure is very much nearer that of urine. Thus a molar solution of sodium iodide is the fluid of choice. It is made by dissolving 15 grm. of sodium iodide in 100 c.c. of water.

The Pressure under which the Opaque Fluid should be Injected.—It has been proved by operations upon kidneys which have been injected shortly before, that very serious damage can be done by pyelography. Usually it has been found that the injection fluid has passed up the collecting tubules into the kidney substance. It has ruptured the delicate secreting tubes and extravasated under the capsule of the kidney. This mechanical damage results from injecting the pelvis under too high a pressure. Further injury is done when the injection fluid is an irritant such as collargol. It is clear, therefore, that the pressure for injection should be less than the secretory pressure of the kidney cells, so that the fluid entering the pelvis cannot pass up the secretory tubules. Now Starling has shown that when the ureter is obstructed the kidney ceases to secrete urine when the pressure in the pelvis reaches a point about 50 mm. of mercury short of

the blood-pressure. This would be approximately 60 to 70 mm. of mercury. Howell states that the pressure in the renal pelvis that will stop renal secretion is 40 to 50 mm. of mercury. The pressure for injection must not rise, then, above 35 to 40 mm. of mercury.

An Apparatus for Injecting the Renal Pelvis.—I have employed the contrivance shown in *Fig.* 503 as a convenient and safe instrument for filling the renal pelvis. The solution of sodium iodide is contained in the graduated tube *A*, to which is attached below a piece of rubber tubing ending in a tapering nozzle which fits into the end of a fine ureteric catheter. This part of the apparatus can be boiled. Above, the tube is closed by a rubber bung through which passes the stem of a T-tube. One limb of this is connected with a manometer *B* which shows the operator under what pressure the sodium iodide solution is being expelled. This expulsion is brought about by means of the bellows *C* in communication with the other limb of the T-tube. Beyond the manometer is a mercury safety-valve *D*. By sliding the tube *E* up or down in its bung, the pressure of the air above the solution in tube *A* may be prevented from rising above any desired point. Above the mercury in tube *D* is a layer of water. The object of this is to damp the movement of the mercury. If it is not there, whenever air escapes through the valve the mercury is broken up into minute globules which are expelled with great force, and even find their way out of the vent in the bung. The valve should be arranged to blow off when the manometer registers between 30 and 40 mm. of mercury pressure.

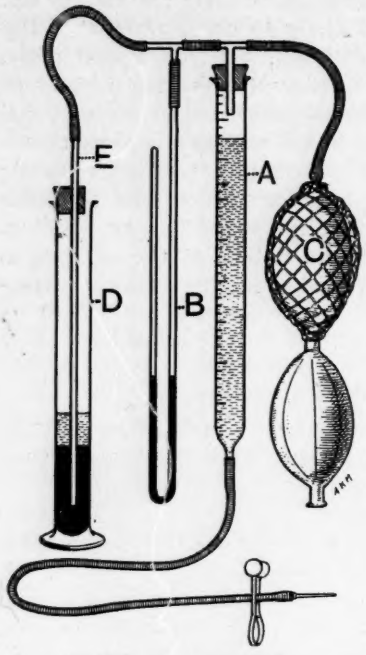


FIG. 503.—An apparatus for pyelography.

Anæsthesia in Pyelography.—The patient, having been purged to prepare him for radiography, is cystoscoped under general or local anæsthesia. Local anæsthesia may be employed for cystoscoping most women and some men ; but it should be more widely recognized that cystoscopy in a certain number of men, especially young highly-strung men, cannot be done entirely painlessly with our present method of applying the local anæsthetic, and the procedure is almost intolerable to others. It is characteristic, however, of the urethra that it easily becomes tolerant to instrumentation. When a patient is used to the passage of bougies, a cystoscopy can nearly always be performed on him with the very least inconvenience. A general anæsthetic is indicated in intolerant patients, and I have also used it for young adult women in whom cystoscopy during consciousness is likely to cause mental distress. If general anæsthesia is employed, the very least that is necessary should be given, and the operation conducted expeditiously in order that the patient may quickly return to consciousness for the skiagram. This is necessary, not that there is any danger of over-distension and injury—with my apparatus there is none—but because it is essential for the patient to hold his breath during the exposure so that the kidney may be still. Only in this way can a good shadow be obtained. The *x*-ray tube having been placed in position above the patient, and a plate beneath him, the fluid is injected at 30 to 40 mm. of mercury pressure. As soon as he complains of any pain in the back, or—in some cases of insensitive hydronephroses—when a considerable quantity has been injected, the exposure is made. The catheter is allowed to remain *in situ* for a quarter of an hour to allow the fluid to drain out. There is no objection to administering a preliminary injection of omnopon $\frac{1}{3}$ gr,. or to giving tinct. opii 20 min. by mouth before the examination, if my apparatus is used. Morphine is not so useful in relaxing ureteric spasm.

V. THE TREATMENT OF HYDRONEPHROSIS.

A.—Physiological Considerations which Influence Treatment.

The choice of treatment lying between nephrectomy and some measure by which the kidney may be conserved, it is essential at the outset to determine two things: (1) The presence of another healthy kidney; and (2) The functional power remaining to the affected organ. The first is established by cystoscopy. Accompanying every hydronephrosis there is always some chronic interstitial nephritis and failure of renal function. By ureteric catheterization the power of concentrating urea, after the ingestion of this substance, or the excretion of phenolsulphonephthalein after injection, can be compared with the power possessed by the opposite healthy kidney. What percentage of urea will make it not worth while to preserve the kidney? Or: What diminution in percentage output of phenolsulphonephthalein will negative conservative measures? The answer to these questions cannot be given at present. Experience in treating cases of enlarged prostate has demonstrated that kidneys whose function has been very seriously damaged by having to secrete against pressure often evince a remarkable power of recovery when the mechanical resistance to secretion is removed, so that one should not be in haste to advise nephrectomy on the information obtained from renal-function tests alone. When, in a case of hydronephrosis, the renal excretory function has been proved to be very depressed, the final decision whether nephrectomy shall or shall not be done will have to be made by visual estimation of the amount of renal tissue left, the organ having been exposed by operation. Braasch says that when the hydronephrosis contains more than 150 c.c. there is very little secretory tissue. Far too often it happens that the patient does not reach the surgeon for treatment until the kidney has been extensively and irreparably damaged, and the uronephrosis is of large size. Thus Simon, in 1914, found it only possible to perform conservative operations in three out of twenty cases, and this reflects approximately the position of affairs in this country hitherto. Now, however, when in the early stages of pain without tumour it is possible to diagnose incipient cases, the proportion of conservative operations should rise considerably. At St. Mary's Hospital during an interrupted period of three years, 15 cases of hydronephrosis (not including the two doubtful cases referred to on p. 518) have come under my personal observation, and have been operated upon either by the senior surgeon to whom I correspond, or myself. Nephrectomy on account of the advanced degree of distention was only performed on 4 occasions. A fifth nephrectomy was done to remove an obstructing tumour. The other procedures carried out were nephropexy 3, pyelotomy for stone 2, pyeloplication 1, ureteropyeloplasty 3. One patient was not operated upon.

The decision to perform a plastic operation having been reached, the question arises whether by removing the hindrance at the upper end of the ureter we have rendered conditions such that the dilated pelvis will shrink and recover its normal function. I think, in view of physiological facts, we have not done sufficient unless we empty the pelvis at the operation, and maintain it so for a considerable time. As we have seen, the ureter will only convey a certain amount of fluid in a given time, and it is likely that with the pelvis distended, and in the presence of polyuria, which so often accompanies the condition, the ureteric mechanism may be insufficient ever to evacuate the pelvis: the more so will this be the case should the pelvic musculature be paralyzed from overstretching, for then urine would enter the ureteric canal from the pelvic cavity only when the pressure in the latter became as great as the systolic pressure of a normal pelvic contraction. Therefore it would seem essential to drain the kidney pelvis after plastic operations, not, as some surgeons suggest, because hæmorrhage may take place and obstruct the pelvic outlet, but to allow of contraction and readjustment of the pelvic wall. I have no doubt this is an important factor in obtaining a successful outcome in plastic work, though some authorities have recommended that drainage be discarded after, for example, ureteroplasty (W. J. Mayo, Kroiss). This is because surgeons have not studied the changes in the pelvis after operation by means of pyelography.

C. S., the patient whose pyelogram is seen in *Fig.* 504, for two years had had intermittent attacks of pain lasting about two days each, which attacks came on finally at intervals of three or four weeks. The capacity of the pelvis was 50 c.c. I performed a pelvi-ureteral plastic operation upon her. She healed without leakage. Three months later she came to see me, saying that during the previous week, on one occasion for a few

FIG. 504.—Hydronephrosis due to a congenital uretero-pelvic stricture.

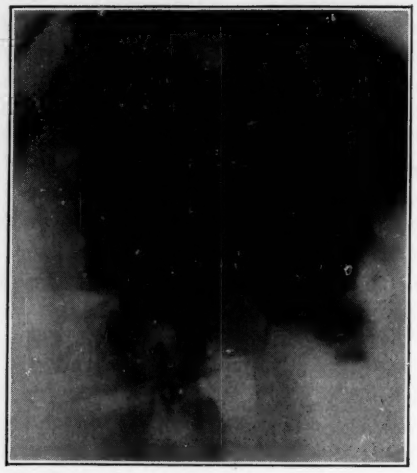


FIG. 505.—Later pyelogram of C. S. (*Fig.* 504), three months after uretero-pyeloplasty.

minutes, she had felt some pain referred to the outer side of her thigh, a situation whence the p in had radiated in the original attacks. On cystoscopy, the pelvis was found to contain 35 c.c. urine, and the pyelogram corroborated this (*Fig.* 505). Comparing it with the condition before operation (*Fig.* 504), it will be seen that the pelvis is not so globular, it has shrunk in size, and the lower calices are not so distended. A comparison of the

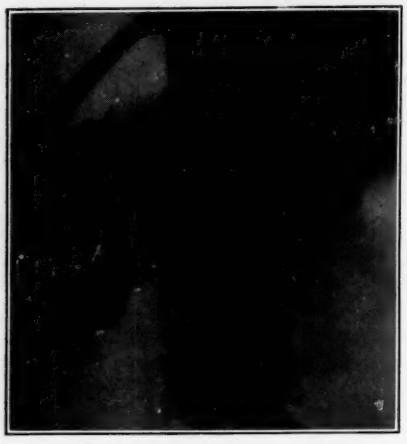


FIG. 506.—Hydronephrosis due to abnormal renal mobility.

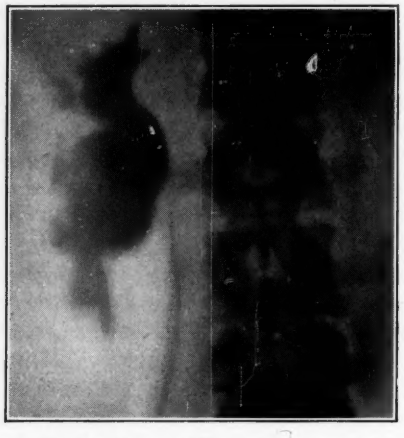


FIG. 507.—Later pyelogram of N. S. (*Fig.* 506), three months after nephropexy.

upper calices is not possible, because unfortunately in the pre-operative pyelogram they are just outside the focus of the tube. That more diminution in volume of the pelvis has not taken place is, I believe, because, owing to the absence of post-operative drainage of the pelvis, this structure was never given a proper chance to contract down. However, there is hope that the process of contraction will proceed. It is significant

also that two other patients operated upon (ureteropyeloplasty), one by myself and one by Mr. W. H. Clayton-Greene, after one year were absolutely without symptoms. A few days after the operation they both leaked urine for four and seven days respectively. This leakage probably served the purpose of drainage. My patient would not consent to examination by pyelography—she was a working woman who could not leave her business—and the other patient was inaccessible, so unfortunately I cannot present pyelograms of these cases. The following case is also pertinent to this question.

N. S., a girl, age 24, had had attacks of pain for seven years and recently had felt a lump in her left side. *Fig.* 506 shows the size of the hydronephrosis. The lump was movable, but not excessively. There were no adhesions around the upper end of the ureter, and a full-sized bougie could be passed from the pelvis down the ureter into the bladder. Nephropexy alone was done. Three months later she returned. She had had no symptoms on the operated side and the kidney was firmly fixed, but she now complained of symptoms on the right side. The right kidney was found to be abnormally mobile. Pyelography was done on both sides. The left kidney pelvis is shown in *Fig.* 507. Not very much contraction has taken place, but it can be seen that the necks of both the upper and lower major calices are narrower than before operation, whilst the pelvis is not quite so globular. The aperture made in the pelvis to pass bougies down the ureter healed without any leakage. This pelvis also should have been drained to allow of shrinkage. In *Fig.* 508 is shown the right kidney. A similar hydronephrotic change is taking place in this organ also.

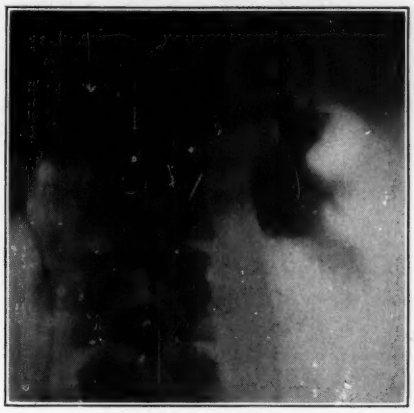


FIG. 508.—N. S. Right kidney. Incipient hydronephrosis due to nephroptosis.

In cases of long-standing prostatic overflow incontinence, the bladder musculature is paralyzed by extreme distention, yet when a suprapubic opening has been made the viscus contracts down speedily, and regains its tone. It is not too much to hope that, with adequate drainage, the kidney pelvis would behave similarly.

The need for drainage from another point of view is illustrated by Grégoire's case. He performed a re-implantation of the ureter. Three days later a typical attack of renal pain occurred, with a swelling in the renal region which lasted four or five days and then disappeared. This he attributes to œdema at the suture-line causing obstruction. A drain in the pelvis would have relieved the tension on the line of suture. He was able to show later, by cystoscopy, that the kidney operated upon was discharging urine into the bladder, though he does not give the ultimate size of the pelvis.

If, at operation, the kidney pelvis be made smaller by resection, return to normal will perhaps be facilitated, for the weight of urine necessary to fill a large pelvis will of itself put a strain upon the muscular wall. Operations of this kind have therefore a certain logical basis. Gayer, two years after a resection of the pelvis, was able to demonstrate by cystoscopy that the pelvis had remained small. Genouville and Leuret were able to do the same after a plication operation.

B.—Conservative Operative Measures and the Indications for them.

These are :—

1. Puncture and aspiration.
2. Nephropexy.
3. Division of an abnormal artery.
4. Removal of an obstructing calculus.
5. Ureteropyeloplasty : (i) Fenger ; (ii) Bazy.
6. Re-implantation of the ureter : (i) Küster ; (ii) Delbet.

7. Lateral pyelo-ureterostomy (Albarran).
8. Pyeloplication (Israel, Albarran).
9. Resection of the pelvis : (i) Inferior (Albarran, Kummel); (ii) Lateral (Thomson Walker).
10. V-shaped incision of a valve (Trendelenburg).
11. Hydronephrocystoneostomy (Schloffer).
12. Combinations of two or more of these procedures.

Puncture of a hydronephrotic sac is the oldest treatment, and, curious to relate, occasionally has been followed by permanent cure. Thus Hue, in 1893, reported one case, well after seven years, and Tillaux relates two others. The case of S. W., referred to on p. 509, is a cure after 20 years. One can only suggest that an ineffective nephropexy was rendered effective owing to perinephritis set up by a little leakage of urine at the three tappings. Puncture can only cure where there is physiological without anatomical obstruction. It is an obsolete method.

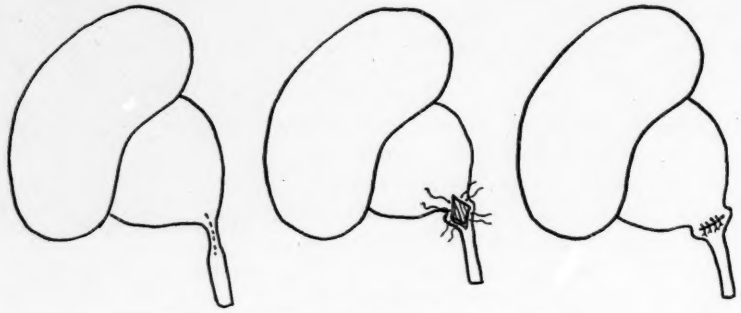


FIG. 509.—Ureteropyeloplasty (Fenger's operation).

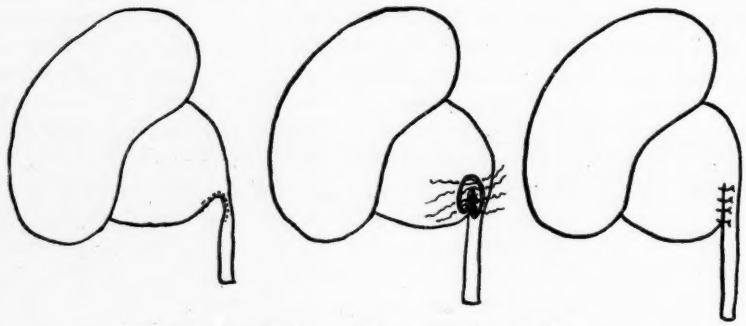


FIG. 510.—Ureteropyeloplasty (Bazy's operation).

Nephropexy is the proper surgical treatment for cases of physiological obstruction accompanied by abnormal mobility. A small tube should be used for draining the pelvis. It emerges from the wound made for the passage of bougies down the ureter. Nephropexy should also always be performed when any plastic operation has been done on the the renal pelvis.

Division of an abnormal artery is insufficient treatment if my view of the insignificant part played by this structure is true. If divided at all a plastic operation or nephropexy must accompany it.

Ureteropyeloplasty is the best operation when there is a congenital stricture and the wall of the ureter is not inflamed or fibrosed. The operation is simple (*Figs.* 509, 510). Catgut should be the material used for the non-penetrating sutures, and a fatty fascial flap is sewn over the suture line. Pelvic drainage must be provided for by a special incision. Ureteropyeloplasty may be advantageously combined with resection of the lower part of the pelvis should the insertion of the ureter be very high.

Re-implantation of the ureter **(*Figs.* 511, 512), or** ***lateral anastomosis*** **(*Fig.* 513), is necessary when the upper part of the ureter is obliterated by disease. Drainage is necessary. Lateral anastomosis of the ureter to the lowest part of the pelvis is a**

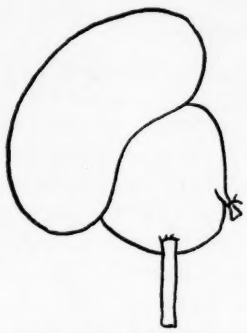


FIG. 511.—Re-implantation of the ureter (Küster's operation).

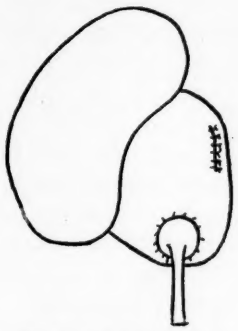


FIG. 512.—Re-implantation of the ureter (Delbet's operation).

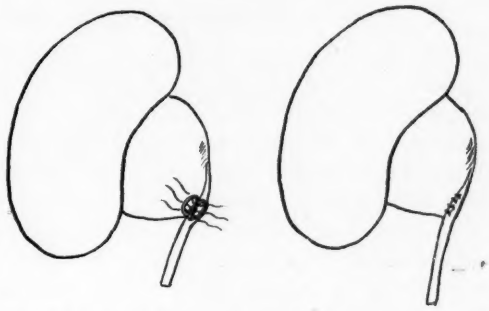


FIG. 513.—Lateral anastomosis (Albarran's operation).

preferable operation, for there is muscular continuity preserved between the pelvis and ureter, whereby the co-ordination of pelvic contraction with ureteric peristalsis is uninterrupted.

Pyeloplication **(*Fig.* 514), and** ***pelvic resection*** **(*Figs.* 515, 516), are indicated when the ureteric orifice is of good size but situated high. Drainage is necessary. These operations may supplement uretero-pyeloplasty.**

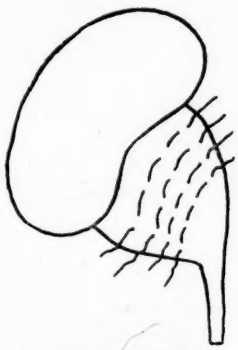


FIG. 514.—Pyeloplication (Israel's operation).

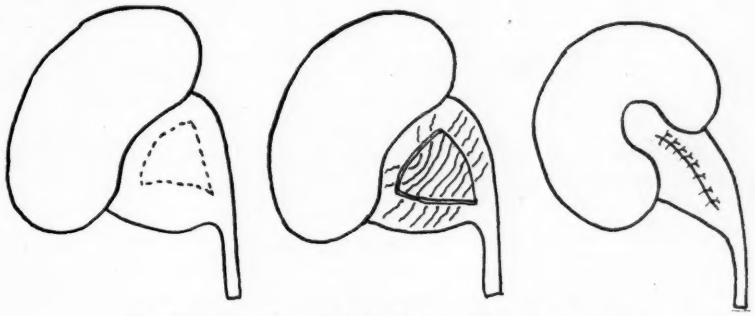


FIG. 515.—Resection of pelvis (Thomson Walker's operation).

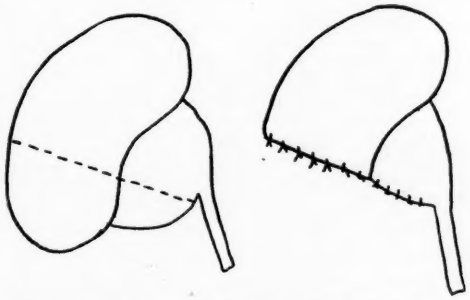


FIG. 516.—Resection of pelvis (Albarran's operation).

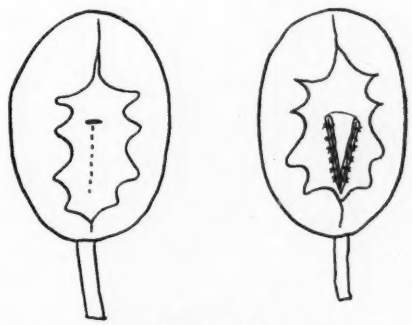


FIG. 517.—V-shaped incision of a valve (Trendelenburg's operation).

Division of the valves **(*Fig.* 517) is very satisfactory when this secondary valve formation has taken place. It is usually done through a nephrotomy wound. Drainage through the kidney is necessary.**

Hydronephrocystanastomosis.—The formation of a communication between the renal pelvis and bladder is very rarely performed. Schloffer did this operation upon a woman with only one kidney which was hydronephrotic.

VI. THE RESULTS OF CONSERVATIVE OPERATIONS.

Legueu has pointed out that published statistics of cure following plastic operations cannot always be relied upon as presenting an accurate picture of end-results. The disappearance and permanent absence of symptoms may, in fact, mean that the affected kidney has become obsolescent. Cystoscopy alone will show if the kidney functions. Rufin's case demonstrates this fact. He performed a valve section combined with plication, and all symptoms disappeared; but six months later cystoscopy showed that the kidney was devoid of function. Legueu distinguishes between cures verified by cystoscopy and clinical successes. There is need for investigation of the end-results of plastic operations by pyelography. The largest series of end-results have been published by Kroiss in 1908 and Legueu in 1910; other end-results are scattered through the literature. The several operations had better be considered separately.

Ureteropyeloplasty.

No. of Cases	Clinical Cures	Verified Cures	Reported by
26	20	—	Kroiss, 1908
5	5	—	Mayo, 1909
18	10	3	Legueu, 1910
3	1	1	Simon, 1914
Total 52	36	4	

= 77 per cent cured of all symptoms.

To these may be added the three new cases reported above, with two clinical cures, and one improved so much that it can practically be called a cure.

Re-implantation of the Ureter.

No. of Cases	Clinical Cures	Verified Cures	Reported by
14	10	—	Kroiss, 1908
3	3	—	Mayo, 1909
12	8	2	Legueu, 1910
1	1	—	Thomson Walker, 1911
2	—	2	Gayer, 1912
1	—	1	Grégoire, 1912
Total 33	22	5	

= 81 per cent cured of all symptoms.

Lateral Anastomosis.

No. of Cases	Clinical Cures	Reported by
11	7	Kroiss, 1908

= 63 per cent cures.

Division of a Valve.

No. of Cases	Clinical Cures	Verified Cures	Reported by
10	8	—	Kroiss, 1908
13	—	10	Legueu, 1910
1	—	—	Gayer, 1912
Total 24	8	10	

= 75 per cent cured of all symptoms.

Resection of Pelvis.

No. of Cases	Clinical Cures	Verified Cures	Reported by
6	6	—	Kroiss, 1908
4	—	4	Albarran, 1909
4	1	3	Legueu, 1910
3	2	—	Thomson Walker, 1911
9	—	9	Gayer, 1912
Total 26	9	16	

= 96 per cent cured of all symptoms.

Pyeloplication.

No. of Cases	Clinical Cures	Verified Cures	Reported by
9	7	—	Kroiss, 1908
7	—	5	Albarran, 1909
2	2	—	Legueu, 1910
1	—	1	Grenouville and Leuret, 1912
Total 19	9	6	

= 78 per cent cured of all symptoms.

Combined Operations.

No. of Cases	Clinical Cures	Verified Cures	Reported by
10	8	—	Kroiss, 1908
1	—	1	Kroiss, 1914
Total 11	8	1	

= 81 per cent cured of all symptoms.

Hydronephrocystanastomosis.

Schloffer reports his case operated upon in 1906 as well in 1920, fourteen years later. He shows pyelograms. The bladder is drawn up locally towards the kidney pelvis, which is still a considerable size. This one would expect, as it is subject to the force of contraction of the bladder during micturition.

Reviewing the results of these plastic operations, it may be said that there is a very fair prospect of preserving functioning hydronephrotic kidneys by their aid. When it is remembered that many of these successes were obtained at a time when diagnosis could only be made by the palpation of a tumour and the condition was necessarily advanced, it will be appreciated that, with our modern methods of diagnosis, the outlook is still brighter in the future.

My thanks are due to Sir Almroth Wright and the several Departmental Directors of the Pathological Institute at St. Mary's Hospital, for affording me facilities to conduct the experimental and histological parts of this investigation.

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MULTICENTRIC ORIGIN OF A RODENT ULCER.

By Sir G. LENTHAL CHEATLE, London.

The main object of this article is to direct particular attention to the remarkable changes in the basal layers of the epidermis and hair follicles which occurred in the skin round a rodent ulcer. The skin was described by Mr. Percy Legg as being infiltrated and not nodular.

Fig. 518.—A bird's-eye view of the rodent ulcer. Eight or nine deeply-stained and isolated groups of cells are seen in the basal layer of the epidermis on the right of the ulcer. X indicates the portion shown in *Fig.* 518A.

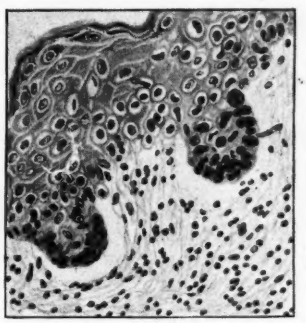
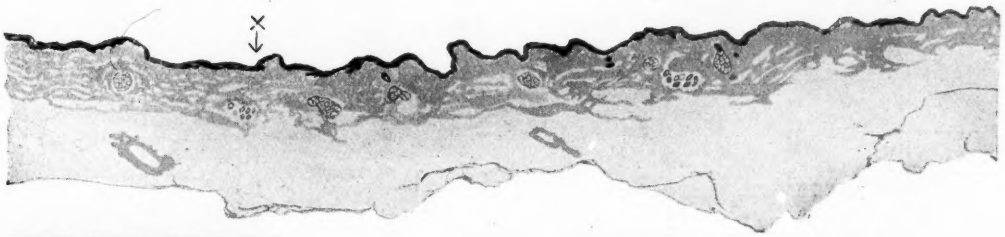


Fig. 518A.—Two of the groups are seen under a higher power, and are dipping into subjacent dermis, in which there are signs of chronic inflammation.



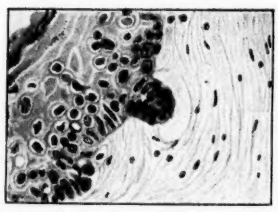


Fig. 519.—A bird's-eye view of the 'infiltrated' skin at some distance from the ulcer in *Fig.* 518. X indicates the portion enlarged in *Fig.* 519A.

Fig. 519A.—Two foci of affected cells under a higher power. Two or three cells only are affected in the lower part of the drawing.

I must make it perfectly clear that these changes occurred in separated, isolated patches which were not in continuity with the rodent ulcer or with each other, and they were not pigmented.

Figs. 518 and 519 are bird's-eye views of the rodent ulcer and 'infiltrated' skin respectively. In these figures many darkly-stained, isolated, and small patches of cells are seen in the basal layer of epithelium; these are situated near the rodent ulcer in *Fig.* 518, and at some distance from it in the 'infiltrated' skin in *Fig.* 519. *Fig.* 521, B shows the same appearances occurring in the basal layer of epithelium in a hair follicle.

Under a high power the following changes may be observed: The pathological process appears to be a gradual one and occurs only in the basal layer of the epidermis and some hair follicles. Two or three epithelial cells stain more deeply than their neigh-

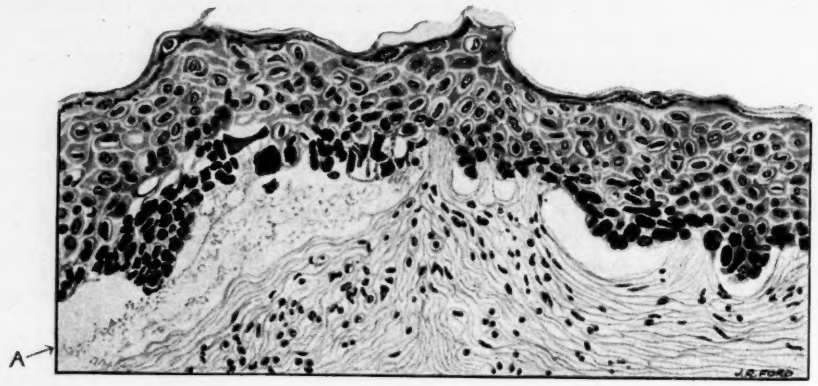


Fig. 520.—A larger area of affected basal cells. Their multiplication is marked. They are surrounded by coagulated fluid (A) in the section.

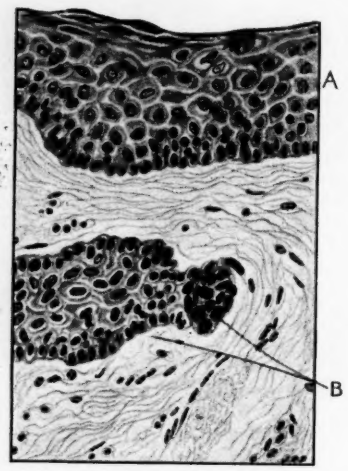


Fig. 521.—The affected cells indicated by the upper line at B are in the basal layer of a hair follicle. A, Epidermis.

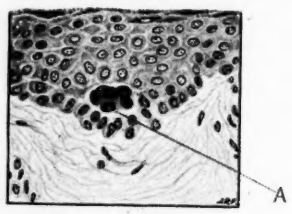


Fig. 522.—Shows a group of alien cells at A above the basal layer in the epidermis taken one inch away from the edge of another rodent ulcer.

bours, and are irregular in size and shape in the smallest lesions. (*See Fig.* 519A.) A further stage exhibits eight or ten cells of the same appearances, but in addition they have multiplied, and penetrated into deeper structures. (*See Figs.* 518A and 519A, and the hair follicle in *Fig.* 521, B.)

A still more extensive area is seen affected in *Fig.* 520, where some fifty or sixty cells are implicated, and their greater multiplication has resulted in a more definite invasion of deeper parts. Invasion is occurring in a branched and forked manner in other parts. There is chronic inflammation surrounding many of the spots where the epithelial changes

have taken place, and it is noticeable that coagulated fluid is encircling every point of epithelial change. (*Fig.* 520, A.)

These remarkable appearances in the skin round the rodent ulcer suggest a multicentric origin of this disease.

The tissues above described were removed by Mr. Percy Legg from the chest of an elderly unmarried female who was under the care of Dr. Arthur Whitfield. I thank them for their permission to refer to these tissues, and they are not responsible for the observations I have made.

The result of the examination of the skin surrounding the rodent ulcer of Dr. Whitfield's patient induced me to examine the skin surrounding other rodent ulcers.

Fig. 522 is a reproduction of the epidermis taken one inch from the edge of a rodent ulcer; a small group of cells can be seen at A, above the basal layer; they are larger, more irregular in shape, and more deeply stained than the normal cells around them. They are not pigmented. It is impossible to say how long they had been in that state and position.

Origin of Rodent Ulcers.—There is some confusion in the minds of authors as to whether rodent ulcers originate in the basal layer of epidermis, hair follicles, sebaceous fluids, or sweat glands. The changes seen in the rodent ulcer of *Figs.* 518 and 519 indicate that their genesis is in the epithelial cells in the basal layer of epidermis and in the basal layer of hair follicles.

SELENIUM IN THE TREATMENT OF MALIGNANT DISEASE.

By A. S. GILLETT and C. P. G. WAKELEY, London.

Owing to the fact that numerous cases of the employment of selenium in the treatment of malignant disease have been reported in surgical literature by several observers during the last seven years, it was deemed advisable to investigate the matter thoroughly, and to collect a series of cases covering a wider and more complete field of observation. This was made possible during the last two and a half years by the kindness and ever-ready help of the surgical staff of King's College Hospital. We wish to make it perfectly clear that this paper is in no way intended to be an essay on selenium therapy, and therefore any reference to the writings of other observers whether at home or abroad has been intentionally excluded. We consider the bare statement of the practical results to be of more value than a bulk of bibliography; at the same time we have thoroughly investigated the reports upon cases published during the last ten years. These reports originate from many sources, and do not embrace a sufficient number of cases to prove of really practical value. Some observers have been content with reporting two cases: this cannot possibly give a basis upon which to draw any reliable conclusions. Therefore this report has been deliberately withheld until over one hundred cases had been dealt with.

To demonstrate the lines upon which the investigation has been conducted, the details of *Case* 1 are given below.

Inoperable Carcinomatous Ulcer of the Tongue.

Date	Local Reaction	Focal Reaction	General Reaction	Pain	Appetite	Weight	Dose, Intra-muscular	Remarks
1919								
July 12	+	0	++	0	0	9 st.	1 c.c.	Jaws can be separated to the extent of 1½ in.
„ 13	+	0	++	0	0	—	1 c.c.	
„ 14	+	0	++	0	0		2 c.c.	
„ 15	+	0	++	0	0	—	2 c.c.	
„ 16	+	0	++	0	0	—	2 c.c.	
„ 17	+	0	++	0	0	—	2 c.c.	
„ 18	+	0	++	0	0	—	2 c.c.	
„ 19	+	0	++	0	0	8 st. 6 lb.	2 c.c.	
„ 20	+	+	++	0	0	—	2 c.c.	Glands in neck larger
„ 21	+	+	++	0	0	—	3 c.c.	
„ 24	+	+	++	0	0	—	3 c.c.	
„ 26	+	+	++	++	0	—	5 c.c.	Ulcer bigger and more septic
„ 29	+	+	++	++	0	—	5 c.c.	
Aug. 6	+	+	++	++	0	—	5 c.c.	
„ 11	+	0	++	0	0	—	5 c.c.	
„ 15	+	+++	+++	+	0	8 st. 4 lb.	5 c.c.	Focal reaction very marked
„ 22	0	++	++	0	0	—	5 c.c.	Injections stopped for a week
„ 29	0	0	0	0	0	—	5 c.c.	Jaws can be separated ¾ inch
Sept. 12	++	++	++	0	0	8 st.	5 c.c.	
Oct. 3	++	++	0	0	0	—	5 c.c.	Very weak
„ 10	++	0	++	++	0	—	5 c.c.	Glands
„ 17	++	++	++	++	0	7 st. 4 lb.	5 c.c.	Ulcer
„ 24	++	+++	++	++	0	—	5 c.c.	A secondary hæmorrhage
Dec. 31	Died							

0 = no change. + = slight reaction. ++ = marked reaction. +++ = very marked reaction.

As will be clearly seen from the above case, one point was very early recognized to be of great importance: that was the question of dosage. At the twelfth injection, when 5 c.c. was administered, the ulcer at once became bigger and more septic; within a fortnight this focal reaction had reached such a height that injections had to be discontinued for a week; they were continued again the following week, when this state of affairs not only continued but became gradually worse, and the patient died in a little over a month. As a result of this it was perfectly obvious that a large dose (5 c.c.), if continued week by week, spelt disaster, and that in future a smaller dose should be given immediately after the maximum had been reached. It did not take long to appreciate the fact that, in the majority of cases, a lower average dose was the only method by which a focal reaction of such intensity as to necessitate cessation of treatment could be avoided.

Systematic blood examinations elicited the fact that a leucocytosis was undoubtedly present after the earlier injections; but not after the later ones. No other blood changes were ever found. This no doubt explains the apparent improvement, both local and general, which is often referred to by the patient. Furthermore, it also demonstrates how easy it is to report on a case with unjustifiable enthusiasm if the patient is watched for eight or ten injections only, and not kept under observation to the end.

Another point the importance of which cannot be overlooked is the influence of the injections upon the general toxæmia present in these cases. After the first few injections this influence is unquestionably beneficial, the toxæmia being diminished—with a concurrent improvement in the general health of the patient. After later injections, however, exactly the opposite state of affairs is seen; the general toxæmia becomes worse, whilst ulceration, necrosis, and secondary hæmorrhage supervene. In that case, why should not only two or three small doses be given, the tragedies following further doses thus being eliminated.

The question of combined treatment was carefully investigated. Neither the combination of selenium with *x* rays nor that of selenium with radium was found to be of benefit.

Lack of space prohibits the publication of details of the whole series; therefore only those of the first fifty are appended. As a result of experience with other colloidal compounds, it was decided that the intramuscular method should be adopted throughout the investigation; this method is in our opinion the most practicable and the most satisfactory.

Of the second fifty cases, thirty have died, ten are in a dying condition, and ten are alive; but of these ten, six are cases of atrophic scirrhous cancer of the breast. In many cases the selenium treatment had to be discontinued owing to the great focal or general reaction. Of the thirty fatalities, death took place in each within eight months of commencing the selenium treatment. Two cases deserve particular mention, in that they show the fallacy of so-called cures, especially when a case is not followed to the end.

1. A middle-aged man was operated on in October, 1918, for a suspicious ulcer of the tongue, extending on to the floor of the mouth. He gave a history of having noticed the ulcer for three months. The growth proved to be epitheliomatous; it recurred later, and was then treated with radium and *x* rays. In September, 1919, selenium treatment was begun. an average of 2·5 c.c. being given every five days. The ulcer slowly diminished, and by December was completely healed. This seemed an apparent cure. But the growth recurred in January, 1920, and though selenium treatment was continued, early and extensive ulceration ensued. The cervical glands were soon involved, increasing in size with rapidity. The patient died in Nov., 1920.

2. A married woman, age 47, was admitted to hospital on Jan. 21, 1920, suffering from ascites. An operation was performed Feb. 3, 1920. Both ovaries were found to be carcinomatous and were removed; there were no secondary deposits. Selenium treatment was begun immediately after she left the hospital, Feb. 16. No recurrence of the symptoms took place, and the general health remained satisfactory until July, 1921, when

the ascites reappeared, with signs of growth in the abdominal cavity. She died early in November, 1921. The selenium treatment was continued until a short time before her death.

It will be noted on perusal of the table below that several cases refused to continue with the treatment—the pain and general reactions being so severe. A marked feature in a great many patients was the insomnia, this frequently being severe and persistent.

In many cases the date of death and of the discontinuation of the selenium treatment did not necessarily coincide. In some death took place during the treatment, while the patients were under our own observation ; in others we are indebted to various practitioners for reports, after the patients had passed from under our notice.

A SERIES OF FIFTY CASES OF MALIGNANT DISE

Case No.	Age	Sex	Tumour		Injections					Period of Personal Observation in Months
			Site	Nature	Method	Average Dose	No. of Doses	Average Interval in Days	Total Dose	
1	73	M.	Tongue	Epithelioma	Intramuscular	3 c.c.	22	5	82 c.c.	Five
2	57	M.	Rectum	Carcinoma	Intramuscular	5 c.c.	5	5	25 c.c.	Three
3	57	F.	Breast	Scirrhous carcinoma	Intramuscular	5 c.c.	12	5	60 c.c.	Eight
4	43	F.	Breast	Scirrhous carcinoma	Intramuscular	5 c.c.	8	8	36 c.c.	Eight
5	75	M.	Tongue	Epithelioma	Intramuscular	5 c.c.	8	7	34 c.c.	Three
6	61	F.	Colon, splenic flexure	Carcinoma	Intramuscular and Intravenous	5 c.c.	15	5	75 c.c.	Four
7	80	M.	Tongue	Epithelioma	Intramuscular	5 c.c.	4	7	20 c.c.	Two
8	46	F.	Cervix uteri	Carcinoma	Intramuscular	5 c.c.	3	5	13 c.c.	Two
9	50	F.	Vulva	Carcinoma	Intramuscular	3 c.c.	3	10	9 c.c.	One
10	73	F.	Breast	Scirrhous carcinoma	Intramuscular	5 c.c.	11	7	33 c.c.	Four
11	48	F.	Breast	Scirrhous carcinoma	Intramuscular	3 c.c.	4	7	12 c.c.	Three
12	34	F.	Breasts	Scirrhous carcinoma	Intramuscular	3 c.c.	12	5	35 c.c.	Five

CONCLUSIONS.

1. Temporary improvement is the most that can be expected.
2. To obtain temporary improvement small doses are essential, the number of injections being limited to eight or ten.
3. Pain and insomnia are aggravated in most cases. On these grounds, or because of the severity of the local reaction, the injections have to be suspended.
4. The weight of the patient follows the same course as in every malignant lesion. We have never seen the gain in weight noticed by other observers.

In conclusion, we wish to tender our sincere thanks to the surgical staff of King's College Hospital for their constant help, courtesy, and unbiased opinion.

DISEASE TREATED BY MEANS OF SELENIUM.

	RESULT
Five	First seen July 12, 1919. History of ulcer two months. Died December 31, 1919, from secondary hæmorrhage after lingual artery had been tied. Post mortem: Malignant glands on both sides of the neck. No other secondary deposits seen. Marked emaciation.
Three	First seen July 25, 1919. History of diarrhœa two months. No constipation. Large ulcerated nodular growth in the posterior wall of rectum. Colostomy performed August 1, 1919. Marked general reaction from injections. Died November 20, 1919. Post mortem: Hard nodular rectal growth extending through the bowel wall into the perirectal tissues. Secondary glands along the aorta and several secondary deposits in the liver. A little free fluid in the abdomen.
Eight	First seen July 28, 1919. History of lump in breast nine months. General reaction marked, injections discontinued after eight months owing to pain. Died August 10, 1921.
Eight	First seen August 29, 1919. History of lump in breast nine months. After four injections growth fungated, and breast was removed. Patient refused further injections as they were so painful. Died August 20, 1920.
Three	First seen June 10, 1919. History of ulcer in mouth two months. Excision of half the tongue with portion of alveolar process of jaw July 2, 1919. Injections commenced, but glands in the submaxillary triangle grew fairly rapidly. Patient became demented, and was sent to an asylum in January, 1920. Died February 2, 1920.
Four	First seen July 20, 1919. Symptoms four months. Transverse colon anastomosed to sigmoid colon July 23, 1919. Abdominal tumour continued to increase in size, and secondary nodules could later be palpated in the liver. Considerable pain after injections. Died November 15, 1919.
Two	First seen September 4, 1919. History six months. Marked focal reaction, so injections were discontinued. Died November 18, 1919.
Two	First seen September 20, 1919. History three months. Pain was so marked after injections that they were discontinued. Died November 18, 1919. Post mortem: Extensive growth into pelvis on each side, almost surrounding left ureter, causing hydronephrosis. Secondary glands along aorta. No other secondary deposits.
One	First seen September 25, 1919. History three months. Local, focal, and general reactions very marked. Died October 27, 1919.
Four	First seen October 20, 1919. History six months. Marked focal reaction. Developed œdema of arm, ascites, and secondary deposits in liver. Died after four months' treatment February 28, 1920. Post mortem: Scirrhous carcinoma invading right side of the chest wall and extending into the pleural cavity. Secondary deposits in the mediastinal glands and in the liver. Much free fluid in abdomen.
Three	First seen October 15, 1919. History four months. Growth fungated through the skin after the injections. Died January 1, 1920.
Five	First seen September 10, 1919. History four months. Right breast amputated September 17, 1919. Left breast amputated October 7, 1919. Skin grafted on both sides. Rapid dissemination. Injections very painful. Died February 10, 1920. Post mortem: The skin over the back and sides of the chest wall was invaded by growth. Secondary deposits were found all over the abdominal cavity and viscera, including the uterus.

Continued on next page

A SERIES OF FIFTY CASES OF MALIGNANT

Case No.	Age	Sex	Tumour		Injections					Period of Personal Observation in Months
			Site	Nature	Method	Average Dose	No. of Doses	Average Interval in Days	Total Dose	
13	33	F.	Breast	Scirrhous carcinoma	Intramuscular	5 c.c.	7	10	26 c.c.	Four
14	73	M	Cheek	Epithelioma	Intramuscular	5 c.c.	10	5	44 c.c.	Three
15	61	M.	Anus	Epithelioma	Intramuscular	4 c.c.	8	7	27 c.c.	Ten
16	44	M.	Rectum	Carcinoma	Intramuscular	5 c.c.	9	5	48 c.c.	Four
17	48	M.	Colon, sigmoid	Carcinoma	Intramuscular	4 c.c.	8	7	24 c.c.	Four
18	76	M.	Bladder	Carcinoma	Intramuscular	3 c.c.	4	7	12 c.c.	Three
19	35	M.	Rectum	Carcinoma	Intramuscular	4 c.c.	5	7	20 c.c.	Two
20	72	M.	Tongue	Carcinoma	Intramuscular	5 c.c.	5	7	22 c.c.	Three
21	75	M.	Tongue	Carcinoma	Intramuscular	5 c.c.	4	7	17 c.c.	Two
22	60	M.	Stomach	Carcinoma	Intramuscular	3 c.c.	4	7	14 c.c.	One
23	35	F.	Glands	Lymphadenoma	Intramuscular	3 c.c.	6	7	16 c.c.	Two
24	65	M.	Prostate	Carcinoma	Intramuscular	4 c.c.	4	7	17 c.c.	Three
25	67	M.	Tongue	Carcinoma	Intramuscular	5 c.c.	7	7	35 c.c.	Three
26	74	M.	Kidney	Hypernephroma	Intramuscular	3 c.c.	3	7	9 c.c.	Two
27	21	M.	Neck	Lympho-sarcoma	Intramuscular	3 c.c.	4	7	8 c.c.	Two
28	70	M.	Palate	Teratoma	Intramuscular	2 c.c.	4	7	8 c.c.	Two
29	58	M.	Stomach	Carcinoma	Intramuscular	5 c.c.	10	7	50 c.c.	Two
30	70	M.	Prostate	Carcinoma	Intramuscular	2 c.c.	7	7	13 c.c.	Two
31	62	M.	Retroperitoneal	Sarcoma	Intramuscular	2 c.c.	4	7	8 c.c.	One
32	56	M.	Cheek	Epithelioma	Intramuscular	5 c.c.	15	5	50 c.c.	Four
33	52	M.	Prostate	Carcinoma	Intramuscular	3 c.c.	7	7	17 c.c.	Two
34	54	M.	Tongue	Carcinoma	Intramuscular	5 c.c.	7	7	15 c.c.	One

DISEASE TREATED BY MEANS OF SELENIUM—*continued.*

RESULT
First seen October 20, 1919. History nine months. Local, focal, and general reactions marked. Died May 3, 1920.
First seen November 20, 1919. History three months. General reaction marked. Developed facial paralysis. Died January 2, 1920.
First seen December 20, 1919. History six months. Colostomy performed. Died October 10, 1920. Post mortem: Marked malignant infiltration of perirectal tissues and of the levatores ani muscles. Malignant glands in both inguinal regions. Marked emaciation.
First seen January 20, 1920. History three months. Colostomy performed March 17, 1920. Focal reaction so marked injections had to be discontinued. Died May 18, 1920. Post mortem: Malignant ulcer of rectum almost perforating the bladder. Large secondary glands on either side of the rectum in the sacral concavity. A few malignant glands at the bifurcation of the aorta. No secondary deposits in the liver.
First seen June 3, 1920. History two months. Colostomy performed August 3, 1920. Injections discontinued owing to pain. Died October 29, 1920. Post mortem: Large nodular carcinomatous mass in the upper portion of the sigmoid colon adherent to some coils of small intestine. Several secondary glands along the aorta.
First seen August 20, 1920. History two months. Permanent suprapubic cystostomy. Injections discontinued owing to pain. Died November 25, 1920. Post mortem: Bladder almost entirely invaded by growth which compressed both ureters, causing bilateral hydronephrosis. A few secondary glands at the sacral promontory.
First seen July 25, 1920. History six months. Colostomy performed July 31, 1920. Injections had to be discontinued owing to pain. Growth ulcerated into bladder. Died October 30, 1920. Post mortem: Large rectal growth which had caused a recto-vesical fistula. Malignant glands in sacral concavity and along posterior abdominal wall.
First seen September 27, 1920. History six months. Injections were discontinued owing to pain. Died January 2, 1921.
First seen September 27, 1920. History four months. Injections discontinued owing to pain. Died December 28, 1920.
First seen October 5, 1920. Injections had no effect on the condition. Died October 31, 1920. Post mortem: Diffuse carcinomatosis of stomach. Secondary glands in lesser omentum, and several secondary deposits in the liver.
First seen October 7, 1920. History nine months. Injections very painful. Died December 12, 1920. Post mortem: Mediastinal glands much enlarged. Liver and spleen typical 'hard bake'. Ascites.
First seen November 12, 1920. Prostatic symptoms for six months. Suprapubic cystostomy performed November 15, 1920. Injections were discontinued owing to pain. Died February 10, 1921.
First seen December 5, 1920. History three months. Marked focal reaction. Septic bronchopneumonia developed, and patient died March 16, 1920.
First seen November 22, 1920. History of renal swelling one and a half years. Hæmaturia worse after injections. Died May, 1921. Post mortem: Secondary glands on both sides of the aorta. Secondary deposits in liver and left lung.
First seen November 2, 1920. History four months. Tumour grew rapidly after injections, and tracheotomy had to be performed. Died December 2, 1920. Post mortem: Enormous mass on left side of neck surrounding the trachea and œsophagus. Secondary deposits in mediastinum and liver.
First seen December 21, 1920. History three months. Injections caused hæmorrhage from growth. Died January 30, 1921.
First seen November 9, 1920. History of gastritis ten months. Gastro-enterostomy performed. Injections were discontinued owing to pain. Died January 20, 1921.
First seen December 10, 1920. Permanent suprapubic cystostomy performed March 1, 1921. Died April 2, 1921.
First seen March 4, 1921. History of œdema of legs three months. Vomiting became so marked after injections that they had to be discontinued. Died April 2, 1921.
First seen December 1, 1919. History two months. Growth excised December 16, 1919. Selenium given, but recurrence soon evident. Died October 25, 1920.
First seen November 5, 1919, when calculus was removed from bladder; no sign of growth. Perineal prostatectomy performed March 8, 1920. Injections had to be discontinued after two months owing to pain. Died June 6, 1920.
First seen August 22, 1920. History nine months. Partial neurectomy of lingual and hypoglossal nerves performed October 20, 1920. Injections were discontinued owing to intense general reaction. Died November 16, 1920.

Continued on next page

A SERIES OF FIFTY CASES OF MALIGNANT DISE

Case No.	Age	Sex	Tumour		Injections					Period of Personal Observation in Months
			Site	Nature	Method	Average Dose	No. of Doses	Average Interval in Days	Total Dose	
35	42	F.	Breast	Carcinoma	Intramuscular	3 c.c.	7	7	22 c.c.	One
36	60	M.	Œsophagus	Carcinoma	Intramuscular	3 c.c.	9	7	25 c.c.	Two
37	70	M.	Prostate	Carcinoma	Intramuscular	3 c.c.	4	7	12 c.c.	Two
38	50	M.	Tongue	Carcinoma	Intramuscular	5 c.c.	25	7	115 c.c.	Three
39	72	M.	Prostate	Carcinoma	Intramuscular	2 c.c.	6	7	12 c.c.	Three
40	25	M.	Femur	Periosteal sarcoma	Intramuscular	3 c.c.	10	7	35 c.c.	Six
41	50	F.	Rectum	Carcinoma	Intramuscular	2 c.c.	23	7	60 c.c.	Six
42	56	F.	Sigmoid	Carcinoma	Intramuscular	4 c.c.	18	5	90 c.c.	Six
43	60	F.	Breast	Atrophic scirrhous carcinoma	Intramuscular	5 c.c.	16	7	80 c.c.	Four and a half
44	49	F.	Breast	Atrophic scirrhous carcinoma	Intramuscular	3 c.c.	8	9	24 c.c.	Eight
45	61	F.	Rectum	Carcinoma	Intramuscular	2 c.c.	10	5	20 c.c.	Six
46	62	M.	Tongue	Epithelioma	Intramuscular	2 c.c.	20	5	40 c.c.	Four
47	58	M.	Tongue	Epithelioma	Intramuscular	2 c.c.	22	5	44 c.c.	Three and a half
48	60	F.	Breast	Carcinoma	Intramuscular	2 c.c.	14	5	28 c.c.	Four
49	47	F.	Breast	Atrophic scirrhous carcinoma	Intramuscular	3 c.c.	16	5	48 c.c.	Nine
50	49	M.	Rectum	Carcinoma	Intramuscular	2 c.c.	16	5	32 c.c.	Five

DISEASE TREATED BY MEANS OF SELENIUM—*continued.*

RESULT
First seen January 5, 1921. History six months. Injections caused no reaction at all. Died March 10, 1921.
First seen February 3, 1921. History five months. Gastrostomy performed March 3, 1921. Died April 16, 1921. Post mortem: Secondary glands in posterior mediastinum. No other secondary deposits.
First seen March 6, 1921. History six months. Focal reaction after injections so marked that they had to be discontinued. Died May 21, 1921.
First seen March 19, 1921. History three months. No change produced in size of tumour. Died June 25, 1921.
First seen April 1, 1921. History one year. Focal reaction very marked. Died July 6, 1921. Post mortem: Base of bladder invaded by growth. Secondary glands at bifurcation of aorta.
First seen December 20, 1920. History of swelling two months. Died from secondary growths in mediastinum August 11, 1921. Injections were discontinued owing to pain. Post mortem: Secondary growths in both lungs, mediastinal glands, and aortic glands.
First seen April 4, 1921. History six months. Injections discontinued owing to pain. Died October 14, 1921.
First seen May 3, 1921. History three months. Colostomy performed May 6, 1921. Died November 10, 1921.
First seen April 2, 1921. History one year. The tumour ulcerated through the skin after the sixteenth injection, and death took place rapidly. Died September 2, 1921.
First seen March 4, 1921. History nine months. Injections discontinued owing to pain. Still alive; tumour has not altered in size.
First seen March 7, 1921. History three months. Colostomy performed; marked general reaction. Died September 10, 1921.
First seen April 4, 1921. History three months. Died from secondary hæmorrhage August 14, 1921.
First seen May 7, 1921. History six months. Injections discontinued owing to pain. Died September 10, 1921.
First seen May 6, 1921. History four months. Treatment discontinued owing to pain. Died September 16, 1921.
First seen February 10, 1921. History two years. Condition *in statu quo*. Still under observation.
First seen April 2, 1921. History three months. Colostomy performed. Injections discontinued owing to pain. Died September 12, 1921.

SOME OBSERVATIONS ON BONE-GRAFTING: WITH SPECIAL REFERENCE TO BRIDGE-GRAFTS.

By C. MAX PAGE and G. PERKINS, London.

The value of bone-grafting has become firmly established both in the treatment of ununited fractures and in the replacement of bone destroyed by disease or injury. A great deal of experimental work has been done with a view to elucidating the changes undergone by various forms of bone-implant in man as well as in animals. Pioneer investigations of this character were conducted by Ollier,[1] Axhausen,[2] Macewen,[3] and others. More recently Hey Groves,[4] Gallie,[5] and Leriche,[6] have contributed valuable data.

In reviewing the conclusions drawn by these and other workers, it must be admitted that some parts of the life-history of bone-grafts in adult man remain obscure, or at any rate matter in dispute. Moreover, there is considerable divergence of opinion as to the technique best adapted to secure a successful result in cases of bone implantation.

The large number of severe injuries to the bones which were caused during the late war have provided an intensive practical experience of the subject, and it would seem that it should now be possible to settle finally the matter at issue. It is with the intention of contributing to this solution that we venture to put forward some observations we have made in the course of treating a series of forty-five consecutive cases operated on for ununited fracture.

Recognizing that the number of our cases forms too narrow a basis to justify dogmatism, we propose in this paper to confine our attention to one section of the subject —namely, *bridge-grafts*.

A bridge-graft may be defined as a bone-implant which fills in a definite gap in the

Results in 25 Cases of Bridge-grafting.

Bone Involved	No. of Grafts	No. of Successes	No. of Partial Successes	No. of Failures	Causes to which Failure was Attributed.
Humerus	5	4	—	1	*Failure* :— 1. Beef-peg used as bridge-graft
Radius	8	8	—	—	
Ulna	6	1	2	3	*Failures* :— 1. Cause unknown. Notes of case incomplete 2. Beef-peg used as bridge-graft 3. Sepsis and insecure fixation of graft to host *Partial Successes* :— 4. Insecure fixation resulting in absorption of upper end of graft and apparent fracture. A pseudarthrosis followed, but the functional result was excellent 5. Mal-union upper end graft to host caused by failure to secure correct alinement before grafting. Graft came adrift, and pseudarthrosis followed, with excellent functional result
Tibia	6	3	—	2	*Failures* :— 1. Insecure fixation, resulting in non-union of graft to host. Graft absorbed 2. Ditto
Totals	25	16	2	6	

original bone and ultimately reconstitutes a part of it. As an arbitrary standard we have included in this category only those examples in which a gap of 2 cm. or more has been bridged. The subjects we have treated have in all cases been adult males, so that the question of new bone-formation from the periosteum as seen in children does not affect the issue. In all the cases quoted, the operation we have carried out has not been the primary one aiming at bone replacement. The period elapsing between the original injury has varied from two to five years. In all the cases the men have been kept under observation from the time of operation up to the present date, or have been restored to industrial efficiency. Radiograms of all cases have been taken at frequent intervals and filed.

The conclusions we have formed in regard to the essential points in the technique of bridge-grafting are most clearly shown by the consideration of our failures. Particular prominence will, therefore, be given to the notes of these cases.

In the 45 cases of ununited fracture treated by some form of bone-implant, 31 come under the classification of bridge-grafts as defined above, the gap in the bone filled being 2 cm. or more. The above table gives the results in 25 of these cases; the remaining 6 promise to be successful, but have not been under observation sufficiently long to warrant their inclusion.

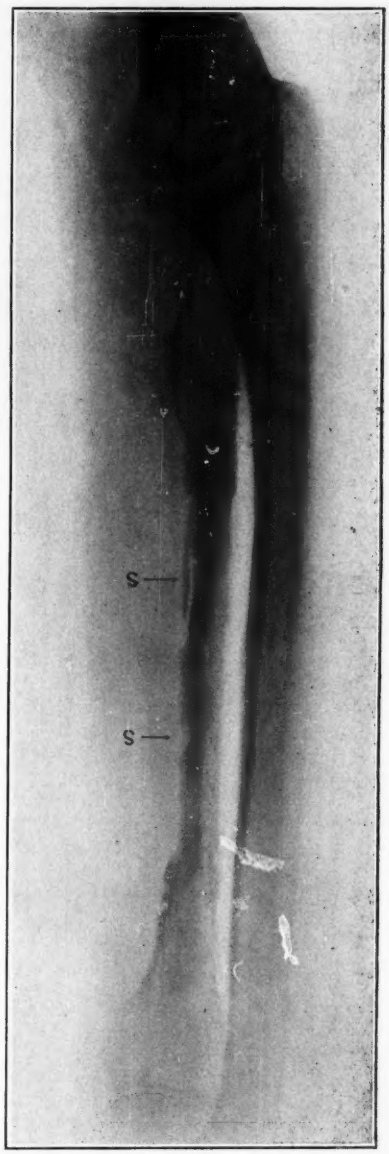


FIG. 523.—Graft in the presence of sepsis. Seven months after graft operation. Graft successful. (S) Sequestra.

I. LIFE-HISTORY OF BONE-GRAFTS.

Brief reference must be made to the most recent theories which have been put forward to explain the fate of bone-grafts when in process of conversion into normal bone. Gallie's views are that when graft and host are held firmly in apposition, capillaries grow in from the host, and that blood circulation is established throughout the graft. The bone-cells on the surface of the graft may live and proliferate, those in the Haversian canals die and disappear in two or three weeks.

Absorption of bone commences at once from the periphery and subsequently involves the whole substance of the graft; meanwhile osteoblasts from the host pass *via* the re-established circulation into the graft, and lay down new bone. Leriche and Policard agree with this view, and consider that the graft acts in the nature of a scaffold. They maintain that the graft always dies; and that, although on exploration the bone of the graft may prove well vascularized and continuous with the host-bone, and that the grafted bone may increase in size and unite after a fracture—these are appearances of life only; their histological examination demonstrates that the bone cells are all dead.

Despite the evidence adduced by these authorities we are not convinced that the graft plays such a humble rôle. We believe that at least some portion of it lives, and becomes incorporated with the host-bone. One salient case may be quoted in support of this view:—

***Case* 14.—Ununited fracture of the radius, middle third; four and a half inches of bone missing.**

He had been previously grafted in February, 1920, and the graft was extruded entire as a sequestrum following suppuration. We operated again in January, 1921, after the wound had been soundly healed for six months. At the operation active granulation tissue was found between the fragments Free suppuration followed within a few days of operation. The temperature fell to normal about the tenth day and at the end of the third week the discharge from the wound was negligible. An *x*-ray picture taken one month after the operation showed the graft in position and firmly united to the host-bone at both ends; there was evidence of new bone formation, and two sequestra were separating from the graft. The wound healed soundly and the graft consolidated. *Fig.* 523 was taken seven months after the operation.

This case shows that an autogenous graft is capable, within a month of implantation, of casting off from itself a superficial portion which has been killed as a result of acute

FIG. 524.—Failure of beef-bone as bridge-graft. One week after graft operation.

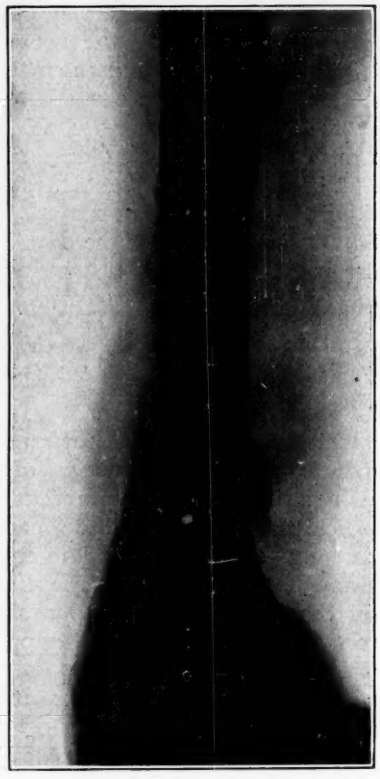


FIG. 525.—The same case as *Fig.* 524, four months after graft operation. Fragments have been apposed by splintage. Callus thrown out from the ends of host, but no new bone creeping along the graft. Inert graft lying in a cavity.

inflammation. Such activity appears to us to be clear evidence of vitality. It may, of course, be maintained that the viable elements of the graft had been derived from the host; but if that is the case, as Gallie and Leriche declare, the process of 'taking over' must be a remarkably rapid one.

If one assumes that a bone-graft dies after implantation and only acts as a scaffold, it is difficult to see why heterogenous or sterilized grafts should not be of the same value as autogenous. There is much evidence in the literature of the subject to show that this is not the case.

We have records of two cases in which boiled beef-bone was used as a bridge-graft; in neither case did the graft take on the appearance and activity of normal bone.

Case 5.—**Ununited fracture of humerus, lower third.**

In May, 1917, the fracture was plated; in June, 1918, the plate was removed, union being absent. In November the fracture was wired without success. In June, 1920, we pegged a section of beef-bone into the medulla of each fragment (*Fig.* 524). An *x*-ray picture four months later (*Fig.* 525) shows the gap closed in as a result of the fragments being approximated by splintage, and callus thrown out from the ends of the two fragments; but the graft has the appearance of a sequestrum; there is no new bone extending along the graft in the way that can be seen in any successful autogenous graft. A plate taken sixteen months after operation still shows non-union. We have since operated again on this case. The graft was found to be quite loose, lying in a cavity which was lined by a smooth-walled layer of fibrous tissue 1 mm. thick.

FIG. 526.—Human bone-graft for comparison with *Figs.* 524, 525. Six weeks after graft operation. New bone creeping along graft. Note the continuity of graft and host where implanted.

Case 10.—Autogenous graft of radius; for comparison with *Cases* 5 and 19. A plate taken six months after operation clearly shows new bone being laid down in continuity with the graft (*Fig.* 526).

FIG. 527.—Failure of beef-bone as a bridge-graft. Six months after graft operation. Condition of graft unchanged.

Case 19.—**Ununited fracture of the ulna, upper third; gap two inches.**

The gap was bridged in April, 1921, by means of a beef-peg driven through the olecranon across the gap, and into the medullary cavity of the lower fragment. Fixation was very firm at the time of the operation. A plate taken two months afterwards shows the graft apparently inert; there is no creeping of new bone along the graft. *Fig.* 527, taken six months after operation, shows little change in the condition except that a space has formed around the peg in the

upper fragment. The peg was removed by operation in November, 1921; it was lying loose in the upper fragment, surrounded by granulation tissue. It was so firmly adherent in the medullary canal of the lower fragment that the latter had to be split before the peg could be dislodged. There was no granulation tissue about the lower part of the graft, and the graft itself was slightly eroded in its upper part only.

These two cases confirm the general evidence that a compact beef-bone peg is useless as a bridge-graft. It is possible that if the beef-peg contained a good proportion of cancellous bone it might be more effectively vitalized, but we have no evidence available on this point as yet. Therefore, we now always employ autogenous grafts for bridging gaps, and only utilize beef-bone when its function is merely that of an internal splint.

II. CHOICE OF BONE: CHARACTER AND SIZE OF GRAFT.

1. **Selection of Bone of Origin.**—In our experience the tibia provides the most satisfactory graft. The bone is easy of access, and considerable latitude in the size and shape of the graft is possible; the gap in the bone from which the graft has been cut is rapidly made good, so that no permanent disability results. If a curved graft is required a rib may be used quite satisfactorily. We have used this type of graft with success in the case of the lower jaw. The use of the fibula is favoured by some surgeons. It has the merit of yielding a strong graft with an established medullary canal. Against the use of this bone one may raise the points that its exposure and separation is not simple, and that its absence cannot fail to unsettle the stability of the ankle-joint. We have not used a graft of this character in the series under consideration.

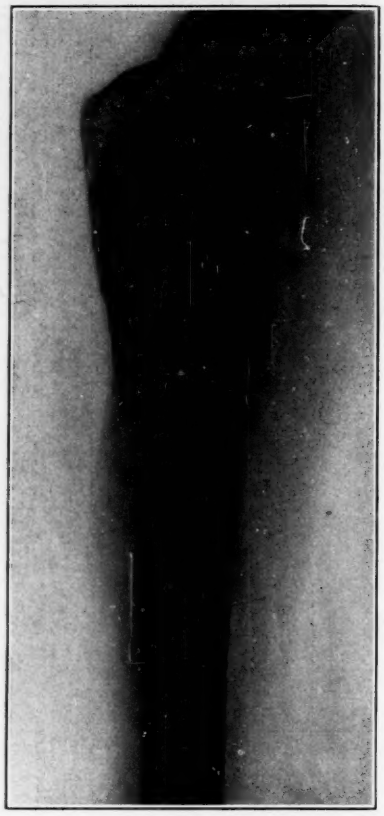


FIG. 528.—Graft too frail, and consequent fracture. Graft has taken. Firm union both ends. Fracture in the middle. Wire remaining from previous operation.

2. **Character of the Graft.**—The constituents of a graft may be compact bone, periosteum, and cancellous bone. The compact bone is essential for strength, though it does not appear to take an active part in the formation of new bone after implantation. In regard to the periosteum, we have come to the conclusion that it has little importance in the re-formation of bone in the adult. From *x*-ray evidence we have not been able to make out that its presence or its absence affects the fate of the implant. It has been our practice in all cases to remove the periosteum from that part of the graft which is fitted into the medullary cavity of the host-bone, and in our later cases we have used grafts free of periosteum, turning back the periosteum from the tibia before cutting the graft.

The cancellous bone seems to be the route along which new bone formation extends from the host-bone into the shaft. It is therefore important to incorporate a good bulk of bone of this character in any graft. (*Fig.* 526.)

3. **Size of Graft.**—The graft should be two or three inches longer than the gap which it is designed to bridge, and so cut that it is as strong as possible consistent with its being fitted into the host-bone. A long graft gives firm fixation, and establishes a larger surface of contact between the host and the graft across which circulation is re-established. The more substantial the graft, the less liable it is to fracture, and the more rapid the re-establishment of full strength in the affected part. *Case* 12, *Fig.* 528, shows the futility of a weak graft.

III. PREPARATION OF THE HOST-BONE.

1. **Preliminary Excision of Overlying Scar.**—This procedure is advocated for many cases of war injury. We have, however, carried it out in two cases only.

2. **Position of the Fragments.**—It is important that the fragments should be able to be brought into their normal alinement at the time the bone is implanted.

Preparatory splinting may occasionally have value in this respect. A method of reducing pronation deformity in the forearm is shown in *Fig.* 529. In our experience, however, reposition can generally be effected only by operative means. This statement is certainly true of a large proportion of war injuries, on account of the gross scarring which occurs about the seat of fracture.

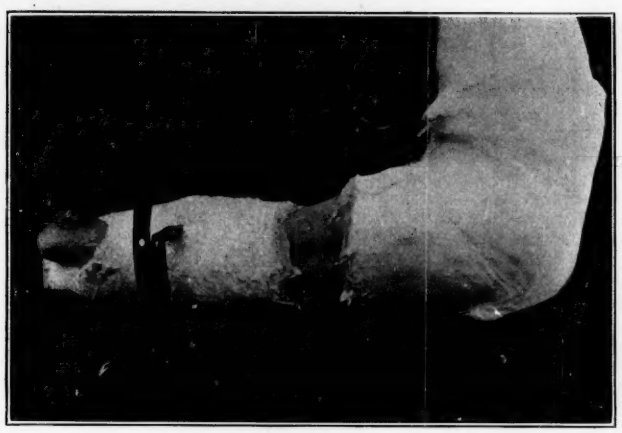


FIG. 529.—Plaster splint to obtain supination.

Case 12 is an example of a failure which may be attributed to the neglect of proper mobilization of the fragments. *Fig.* 530, taken ten months after a second operation for grafting, shows displacement of the upper fragment, and that the adjacent end of the graft is no longer in contact with the host-bone.

3. **Removal of Sclerosed Bone.**—We consider it of fundamental importance to resect both ends of the host fragments until healthy vascular bone is exposed.

FIG. 530.—Host fragments not brought into correct alinement. Adduction of upper fragment not well shown. Ten months after graft operation. Graft separated from host above. Pseudarthrosis resulted. Surgically a failure. From a functional point of view the arm is excellent.

IV. INTERNAL FIXATION OF THE GRAFT.

This appears to be the most essential factor in effecting a successful bridge-graft.

Unless the graft becomes firmly united with the host at both ends success is unlikely. The presence or absence of this union can be detected very early after operation by means of radiograms. *Figs.* 531 and 532, from different cases, may be compared in illustration of this point; both plates were taken ten days after the

graft had been inserted. *Fig.* 531 shows a stout graft in good position, but a space is shown intervening between the graft and the host-bone. The graft failed, and the upper end became absorbed. *Fig.* 532 shows a similar graft, but there is union between the graft and host at both ends, with no space showing between the graft and host in the *x* ray. This graft was successful.

The method of fixation matters little, providing that it is firm. For most cases we have found that the mechanically soundest method of effecting fixation is to peg one end of the graft into the medulla, and to fit the other into the medulla by what may be termed an inlay splice (*Fig.* 533). One end of the

FIG. 531.

FIG. 531.—Infirm fixation of graft to host, and consequent failure of graft. Ten days after operation. Stout graft. Position good, but space exists between graft and host. The graft was absorbed, and failed.

FIG. 532.—Firm fixation of graft to host, and consequent success of graft. Compare *Fig.* 531. Ten days after graft operation. Stout graft. Position good. No space visible between graft and host. Firm union has taken place. Graft successful. Graft fixed with pegs (P).

FIG. 533.—Method of fixation of bridge-graft. (A) The graft pegged into the medullary cavity of one fragment for an inch or more. The other fragment is prepared by cutting a slot slightly less wide than the graft. A saw-cut is made through the compact bone for a short distance beyond the end of the slot to enable the latter to open sufficiently to receive the graft. (B) The graft forced into the slotted fragment, in which it should be firmly held by the elastic recoil of the bone.

FIG. 532.

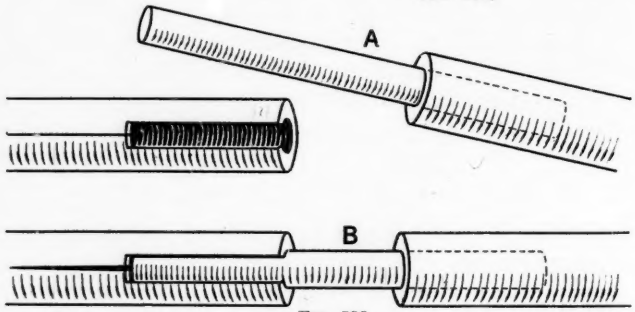


FIG. 533.

graft is driven firmly into the medullary cavity of the most mobile fragment. In the other fragment a slot is cut, about 1 mm. narrower than the graft, out of the compact bone. The slot is cleared by means of a small gouge. A saw-cut about 2 cm. in length is made in the compact bone at the extremity of the slot. To introduce the graft, the slot is opened slightly by forcing a chisel into it, and the graft is then crushed home into its bed with bone forceps. In some cases tapping with a hammer is used to assist the process.

We sometimes employ catgut, kangaroo tendon, or even wire ligatures to bind the spliced part of the graft in place; but their use should be superfluous. Our experience inclines us to the belief that if the host and graft do not remain in apposition without being

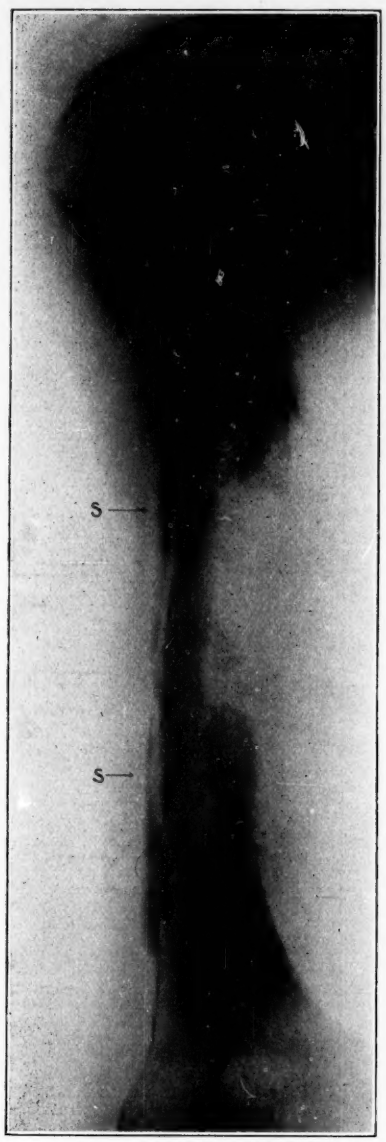


FIG. 534.

FIG. 534.—Graft in the presence of sepsis. Seven months after graft operation. Lower portion has taken in spite of sepsis. One large sequestrum is separating from the graft above, and another from the host and graft below. The upper end subsequently came adrift. The lower end remained firm. (S) Sequestra.

FIG. 535.—Same case as *Fig.* 534. Shows final result. Humerus short, but arm function excellent. The lower end has been pegged into the upper after removal of sequestra.

FIG. 535.

held by sutures, their subsequent union is doubtful and the graft likely to be a failure. Foreign material introduced to effect fixation, such as wires, pegs, bolts, and plates, we hold to be undesirable—necessary at times, but always to be avoided if possible. If suppuration occurs, the graft survives intact long enough, and the skin wound heals soundly; but if foreign materials are present, sinuses down to them will inevitably form, and will persist till the dead material is removed.

V. BEHAVIOUR OF GRAFTS IN THE PRESENCE OF INFECTION.

As a general principle it is accepted that the graft should be aseptic and that it should be implanted into an aseptic field ; but infection and a successful graft are not incompatible, provided that the graft is firmly embedded in the host-bone at both ends. *Case* 14 (*see* p. 542) illustrates this ability of a graft to thrive, despite severe infection of the surrounding tissues. *Fig.* 523 shows the condition present seven months after operation.

In *Case* 24, an ununited fracture of the humerus (*Fig.* 534), acute infection set in after the implantation of a graft. The graft came adrift at the upper extremity, but below it united firmly with the host. Sequestra formed both from part of the graft and from the host, and were removed. A few months after the wound had finally healed, the upper free end of the graft was pegged into the medulla of the upper fragment of the humerus, the final result giving a sound though shortened bone (*Fig.* 535).

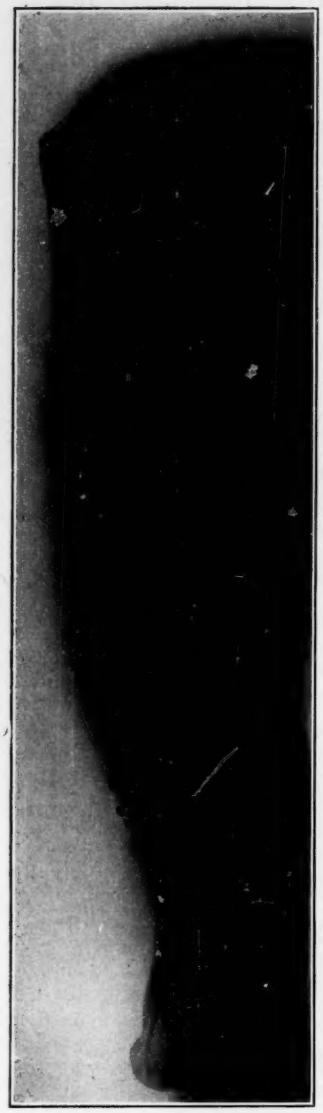


FIG. 536.—Non-union of graft to host, and consequent apparent fracture. One month after graft operation. Firm union below. No union above, with clear space between host-bone and graft.

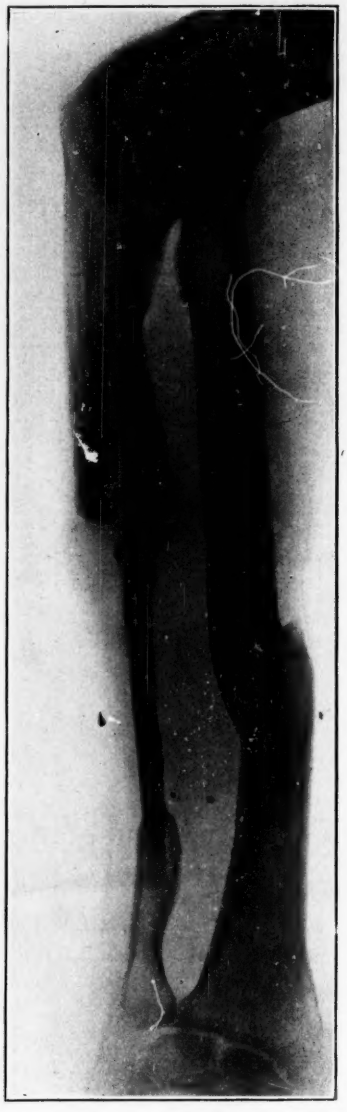


FIG. 537.—Same case as *Fig.* 536, five months after graft operation. Apparent fracture at the junction of graft and host above, and absorption of loose upper end of graft.

VI. GRAFT FRACTURES.

Excluding the early cases due to fragility of the original graft, as in *Fig.* 528, graft fractures may be recognized as falling into two distinct varieties. The two types occur at different periods after implantation, in different situations in relation to the graft as a whole, and as a result of different causes.

1. **The Early Fractures.** — These often take place within eight weeks of the operation, while the limb is still firmly immobilized and little or no strain is passing through the bone. This fracture occurs at one site only, namely, at the junction of the host and graft. It follows non-union of one end of the graft with the host-bone, and is due to the process of osteoclasis proceeding without its being followed by any new bone formation. In fact the graft is subject to the same changes which have been observed to occur when it is implanted into soft tissues. These cases, though often classified as fractures, are there-

fore really examples of bone absorption secondary to inadequate fixation of the graft. *Case* 4 illustrates this point. *Fig.* 536 was taken within a month of the operation; it is evident that the graft is firmly united below, but loose above. The upper part of the graft became slowly absorbed, and *Fig.* 537, taken five months after the operation, gives the appearance of a fracture at this level.

2. **Late Fractures.**—These may occur at any time up to two years from the date of operation. The graft has been successful; it is firmly united at both ends and is increasing in size; the limb has been released from complete immobilization and is exposed to some strain. The fracture is caused in the same way as a fracture of the normal bone—namely, because the new section of bone is called upon to bear a strain greater than its strength will stand. The site of fracture is variable, but is usually about the middle of the graft.

Case 3 is a good example. After a gap in the tibia had been successfully bridged, the patient was walking

FIG. 538.

FIG. 538.—Fracture of graft due to inadequate support. Ten months after the fracture. Fracture is obvious.

FIG. 539.—Fracture of graft due to inadequate support. Seven months after successful graft operation. Graft was fractured one month previously and is now uniting. Callus visible around seat of fracture, which is almost at the upper junction of host and graft.

FIG. 539.

in a plaster splint which fitted too loosely, and six months after the operation sustained the fracture. *Fig.* 532, taken ten days after operation, shows firm union between the host and graft. A radiogram taken shortly after the fracture shows this as a fissure. In radiograms taken at monthly intervals the line of fracture becomes more apparent. *Fig.* 538 was taken ten months after the fracture had occurred.

The early fractures are due to faulty technique in respect of the fixation of graft to host; the late fractures are traumatic, and do not denote any shortcoming on the part

of the primary operative technique, but are due either to insufficient support of the injured bone, or rashness on the part of the patient. The prognosis of the two varieties differs. In the early fractures the graft has definitely failed to take on its intended function, and union cannot be expected. In the case of the traumatic fractures union does occur, at any rate in some cases. *Case* 15 had a bridge-graft of the tibia which broke eight months after operation, both ends being firmly consolidated. *Fig.* 539 shows the presence of a fracture in the graft which occurred a month previously, and which shows signs of uniting. In our experience the process of union in fractures of this kind is a slow one, and we incline rather to implant a new graft in order to save time. This was done in *Case* 3.

VII. POST-OPERATIVE TREATMENT.

This may be divided into three clinical stages, as follows :—

1. **Stage of Absolute Rest.**—This comprises the first six weeks following operation. The joints above and below the graft are firmly immobilized in a plaster-of-Paris casing applied on the operation table. During this period the graft is establishing a vascular continuity with the host at either end and with the surrounding tissues ; unless this process is completed a graft will fail.

FIG. 540.—Plaster walking splint. Thin stocking only under the plaster. Plaster closely moulded to the leg. Free range of movement allowed at knee and ankle.

2. **Stage of Partial Function.**—After the expiration of about six weeks, light use of the limb is permitted, a splint being applied so as to support the bone while allowing movement at the adjacent joints. In the case of fractures of the tibia a closely fitting plaster is applied, moulded above around the bony points below the level of the knee-joint, and below to the malleoli (*Fig.* 540). This apparatus will allow free movement at the knee and ankle, but gives considerable vertical support to the bone. In the forearm a plaster casing is applied with the arm in the extended position ; it reaches from the middle of the arm above to the level of the wrist below.

3. **Stage of Full Function.**—When the graft has consolidated, and is estimated by means of radiograms to have the strength about equal to half that of the normal bone, all splints are removed, and the nutrition of the limb is restored by massage, faradism, and active use. The change from the stage of partial function to that of full function depends on the individual bone involved. For example, full freedom can be allowed in the case of fractures of the radius much earlier than in the case of the tibia. No definite rule can be laid down for all cases, and some conservatism will certainly avoid the incidence of disappointing fractures.

VIII. OTHER FACTORS INFLUENCING THE SUCCESS OF BRIDGE-GRAFTS.

1. **Bone Involved.**—It is generally accepted that the probabilities of successful grafting vary in the different bones.

The humerus we have not found to offer any special difficulties, provided satisfactory splint fixation is effected. It is seldom that a wide gap has to be bridged in this bone, as considerable shortening is consistent with good function.

In our experience, in common with that of others, the radius can be grafted with the greatest ease. We have had no failures in ten consecutive cases.

The ulna is undoubtedly less satisfactory. It is difficult to imagine that the vascular supply of this bone is so different from others as to be the cause of the difficulty. Two factors suggest themselves :—

a. That at the time of the operation the fragments are not sufficiently mobilized to make it possible to aline them without splints; the upper fragment is nearly always flexed and deviated to the radial side.

b. That the common position of immobilization after grafts of this bone is incorrect. We have generally fixed the limb after operation at an angle of about 110° in these cases. The fact that in simple fractures of the forearm the fragments are most correctly alined in full extension suggests that this position may be the proper one for fixation after graft operations on this bone.

FIG. 541.—Graft of radius and ulna at the same operation. Two months after graft operation.

In our experience there is no objection to grafting both bones of the forearm at the same operation. *Case* 16 is an instance of this procedure, undertaken secondary to an operation for shortening both bones which had failed to produce union. *Fig.* 541 shows the two grafts in position two months after our operation. *Fig.* 542 shows the condition seven months after operation.

In the tibia, grafts in the lower third have a doubtful prognosis. This is possibly due to the difficulty in immobilizing the lower fragment. Grafts in the upper and middle thirds give good results.

2. Latent Infection of the Host-bone.—In our early cases we were inclined to attribute some of our failures to the presence of infection. But with an improved technique and a more extensive experience of the subject we think that it is seldom, if ever, a causative factor. It would appear, in reviewing our unsuccessful cases, that inadequate fixation of one end of the graft is the common factor responsible for failure.

FIG. 542.—Same case as *Fig.* 541, seven months after operation. Graft successful.

SUMMARY AND CONCLUSIONS.

The subject matter of this paper relates only to bridge-grafts in the adult.

1. From the evidence of radiograms it would appear that bone implants possess and retain a vital activity for some period independent of the tissues of the host.

2. Boiled beef-bone cannot be used successfully as a bridge-graft; it is, however, valuable if employed as an internal splint.

3. For successful bridge-grafting the graft should be autogenous. The most satisfactory source for most purposes is the tibia. The graft should contain sufficient compact bone for strength, and as much cancellous bone as possible. It is in relation to the cancellous part of the graft that firm union with the host-bone takes place, and that new bone is laid down to thicken the implant in the first few months after implantation. The presence

or absence of periosteum on the graft does not appear to affect its vitality or its later enlargement in response to function.

4. Two steps are necessary in the preparation of the host fragments: (*a*) Removal of the sclerosed ends till healthy vascular bone is exposed; (*b*) Mobilization of the fragments so that they can be normally alined without tension.

5. The most important factor governing success is the firm fixation of the graft into both extremities of the host-bone.

6. The method of fixation of the graft found most satisfactory for the average case is by intramedullary pegging at one end and by an inlay splice at the other.

7. Fractures of the graft fall into two categories: (*a*) Apparent fracture at the junction of the host and graft; these fractures occur at an early stage, and are due to the weakening of the implanted part of the graft by absorption which results when it is not in firm contact with a healthy section of host-bone. (*b*) Fractures in the free part of the graft; these occur from inadequate support of the limb after the implanted ends of the graft have become firmly incorporated with the host-bone.

8. Post-operative treatment may be divided into three clinical stages: (*a*) During the first six weeks absolute immobilization of the part involved; during this stage the graft unites firmly with the host-bone. A radiogram taken at this period will show whether or not the graft is successful; if implantation of the graft has been so carried out that vital continuity between it and the host-bone becomes established, no space is seen between the graft and the host-bone in the picture; if fixation has not been firm, a clear area is seen between the graft and the host-bone, and the related part of the graft will become gradually absorbed, and finally give the appearance of being fractured where it is in contact with the host-bone. (*b*) After six weeks, partial function of the limb involved is allowed, adequate splint support being supplied to prevent fracture from undue strain. (*c*) When the graft in response to function has sufficiently thickened, all support is removed, and the return of full nutrition and activity in the limb is assisted by physiotherapy.

9. The ease with which successful bridge-grafts can be carried out varies in different bones. The radius gives the largest proportion of successes. The upper third of the ulna and the lower third of the tibia have been found to be the most difficult.

10. We have attributed most of our failures to unsatisfactory fixation of one end of the graft to the host-bone.

11. Post-operative infection of the wound is not incompatible with the survival and growth of a bridge-graft.

We wish, in conclusion, to acknowledge our debt to Drs. R. J. Reynolds and W. P. Tindal-Atkinson for their invaluable help in taking the radiograms upon which this study has been based. We are also much indebted to Mr. G. W. Heckles for the careful records which he kept of the earlier cases of the series referred to in the text.

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EXCISION OF THE OS CALCIS FOR TUBERCULOUS OSTEITIS: A LATE END-RESULT.

By C. P. G. WAKELEY, London.

This case is recorded with the view of showing how little deformity and disability occurs after excision of the os calcis. The operation was performed twenty-one years ago on a patient with a very bad tuberculous history. The following is a report of the case :—

Miss E. B., age 20, was admitted to King's College Hospital, in 1900, under Mr. Burghard, with two tuberculous sinuses in her left heel leading down to the os calcis. One of her brothers suffered from tuberculous abscesses in the neck for several years previous to her admission to hospital. Her left ankle first became swollen at the age of ten ; later, an abscess formed and an operation was performed at University College Hospital, and after this the ankle was operated upon five times. The foot remained

FIG. 543.—Lateral view of the foot from which the os calcis was removed in 1900.

FIG. 544.—Skiagram (antero-posterior view).

healed for two years from 1894 to 1896, when a swelling appeared at the outside of the foot and, later, a sinus formed on the inner side of the ankle. Rest and immobilization fai'ed to relieve the condition, and an operation was decided upon by Mr. Burghard. An incision was made along the outer border of the foot backwards from the 5th metatarsal, and continued round the back of the heel to a point below the inner malleolus. The deep fascia was divided, and the soft tissues were dissected off the surface of the os calcis. The peronei and other tendons were drawn out of position. The various interosseous ligaments having been divided, the os calcis was finally detached from its surroundings and removed. The flaps were drawn together and sewn up with silk stitches. The wound healed soundly. On cutting open the excised os calcis a tuberculous deposit was found, extending from its centre to the nner edge of the bone and opening at the site of the sinus. The patient was not seen again until October, 1921. She had married, and continued to enjoy very good health. She could walk considerable distances—

several miles—without pain or fatigue. There was not the least sign of a limp. There appeared to be about half an inch of shortening of the left leg; the reason for so little shortening appeared to be due to an excessive deposit of fat and fibrous tissue in the region of the heel. The lateral view of the foot (*Fig.* 543) demonstrates this well. The two skiagrams (*Figs.* 544, 545) taken in two directions show the complete absence of the os calcis; some of the other tarsal bones give evidence of old-standing chronic osteitis.

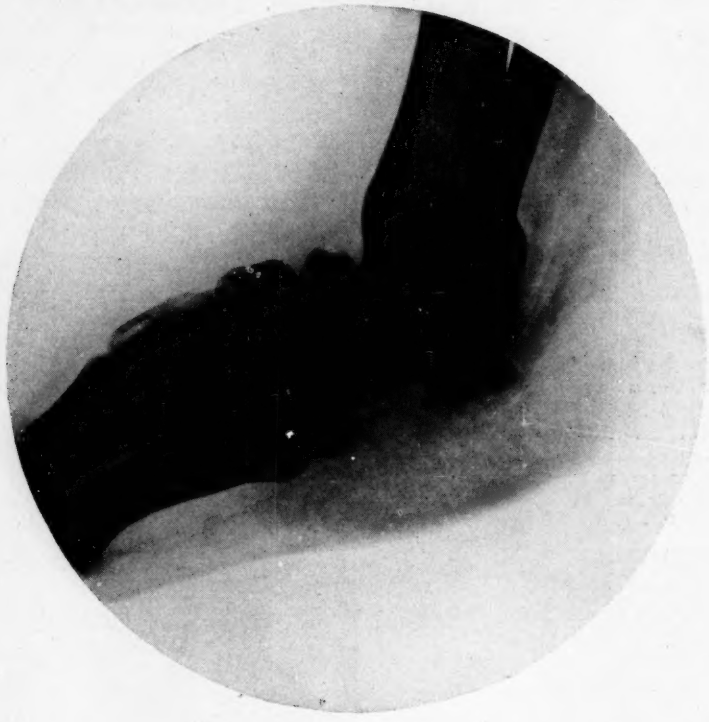

FIG. 545.—Skiagram (lateral view).

It is well known that very excellent functional results are obtained after removal of the os calcis in childhood. This case is interesting as showing that perfect function may follow without any alteration in the remaining bones of the tarsus. Two other cases may be mentioned, both operated upon by Mr. Burghard, in which the functional result was equally good. One was that of a girl, age 24, with a condition of the os calcis very similar to that described above. The removal of the os calcis by the same incision was done ten years ago, and the patient walks perfectly with a cork wedge in the heel of the boot. The other case was in a man, age 32, for a shrapnel wound of the bone, which was extensively crushed. The operation was done in 1916, and the result is excellent.

RECURRENT ANTERIOR DISLOCATION OF THE LOWER END OF THE ULNA COMPLICATED BY UNUNITED FRACTURE OF THE STYLOID PROCESS OF THE ULNA.

By A. PHILP MITCHELL, Edinburgh.

The infrequent occurrence of cases of recurrent luxation of the lower end of the ulna justifies the publication of the following case, which was demonstrated at a special meeting of the British Orthopædic Association in Edinburgh, in June, 1920.

J. McK., age 23, was admitted to the Edinburgh War Hospital, Bangour, on Nov. 10, 1919, with the complaint that movements of the forearm were painful, and were frequently followed by dislocation at the wrist.

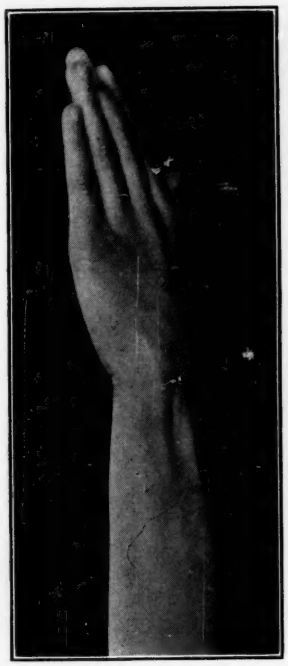

Fig. 546.—Wrist before operation. Note narrowness of the wrist and sharp edge of the radius bounding laterally the depression left by the ulnar head.

On Examination.—The condition shown in the photograph (*Fig.* 546) was obvious. The patient could, with ease, produce the dislocation by extreme supination, and as easily accomplish its reduction. On pronation the ulnar head slipped back into place; but it could readily be pushed backward and forward. Lateral separation from the radius was not possible. The wrist was narrower than normal, and its anteroposterior diameter was only slightly increased. The outline of the wrist as seen from the back was curious. The normal dorsal prominence of the ulnar head had disappeared, leaving a depression which began above in a gradual slope, was bounded laterally by the sharp edge of the radius, and inferiorly by the somewhat abrupt edge of the now prominent cuneiform. The ulnar head was dislocated forward and slightly inward, and was palpable under the flexor tendons. The interference with the function of the forearm was sufficiently marked to be a source of annoyance, and there was also evidence of a secondary ulnar neuritis. Radiograms taken twenty-one months after the original injury showed that the dislocation was complicated by an ununited fracture of the styloid process of the ulna. The radius was intact (*Fig.* 547).

Fig. 547. — Recurrent anterior dislocation of the ulna complicated by ununited fracture of the styloid process of ulna. Radius intact.

Previous History.—There was a history of the patient having fallen down on Feb. 9, 1918, sustaining an injury to his right forearm. He was treated for fracture of the forearm, and sent back to duty at the end of three weeks. Being granted five days' leave, he consulted his family doctor because he was unable to move his forearm without pain and dislocation at the wrist. His doctor noticed the tendency to dislocation

of the lower end of the ulna, and supplied him with a splint which was removed when the patient returned for duty. He frequently reported sick and, as the result of a Special Medical Board, he was ultimately discharged from the army on Sept. 6, 1919.

Surgical Anatomy.—The lower end of the ulna is excluded from the wrist-joint by the triangular fibrocartilage which is attached by its apex to the depression at the root of the styloid process of the ulna, and by its base to the medial border of the lower end of the radius. This triangular cartilage is the only ligament in the lower radio-ulnar articulation which maintains the ends of the bones in apposition, and moves with the radius—backwards on the lower end of the ulna in supination, and forwards in pronation. The anterior and posterior radio-ulnar ligaments are weak, and have little influence in retaining the bones in apposition. They extend transversely in front and behind the joint, and limit its rotatory action.

FIG. 548.—Six weeks after operation.

Pathology.—Recurrent forward dislocation of the head of the ulna would appear to be an extremely rare condition, and is sometimes seen following violent trauma in this region. Darrach,[1] in 1913, recorded a single case and referred to three cases described by Hoffa[2] and three by Courtin[3]; beyond a mere reference to its possibility, the writer has failed to collect further cases.

The essential lesion is not the lack of reduction, but the result of the imperfect repair of the triangular fibrocartilage which has been ruptured, or separated from its ulnar attachment by the tearing away of the styloid from the ulna close to its base. The ulnar head thus loses its stability, and a lax joint results. This laxity may be only an abnormal mobility of the ulnar head, interfering but slightly, if at all, with the function of the wrist, or it may be sufficient, as in the case under review, to permit the head to slip out of the sigmoid cavity. The impairment of function in this case was sufficient to warrant the carrying out of the operative measures to be described later.

In passing, it may be noted that dislocation at the lower radio-ulnar articulation as a complication of Colles's fracture is far more common, and whilst it is usually reduced with the fracture and a satisfactory result follows, the condition is sometimes not recognized until the swelling has disappeared and the splints have been removed.

Uncomplicated forward luxation of the lower end of the ulna also occurs. In working up the subject, Cotton and Brickley[4] collected and published the records of twenty-eight cases.

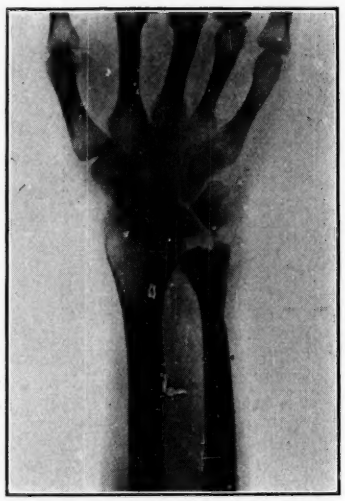

FIG. 549.—Three months after operation.

Operative Treatment.—Just as the symptoms of recurrent luxations differ considerably from those of the acute condition, so in the case of treatment. Operative treatment is practically never indicated in recent cases unless the condition is a complication of Colles's fracture, and open treatment is necessary to effect or maintain reduction. In recurrent cases, however, operation is an essential procedure.

The writer, not having access to surgical literature at the time, devised the following operation (Dec. 12, 1919). An incision was carried down to the bone along the subcutaneous dorsal border of the ulna in its distal fourth, and then extended downwards to

the level of the cuneiform. Having separated the ulnar periosteum, the lax capsular ligament of the lower radio-ulnar articulation was incised, its edges were retracted, and the detached styloid process of the ulna was removed. With an Albee saw, a sliding graft, 1½ in. long and ⅜ in. wide, was taken from the lower end of the ulna. The proximal end of the graft was trimmed and made more or less pointed in order to simulate a styloid process. The graft was turned round completely so that the proximal end became the distal, and projected for ¼ in. beyond the lower end of the ulna (*Fig.* 548). Interrupted 'looped' tanned catgut sutures passing through the periosteum and carpi ulnaris muscles on either side, fixed the graft. The edges of the lax capsular ligament were overlapped, and stitched with tanned catgut. The skin edges were united with interrupted silkworm-gut stitches. The hand, wrist, and forearm were controlled in a position of two-thirds complete pronation by means of a plaster-of-Paris case. At the end of four weeks the plaster was removed and the skin stitches were taken out. As the wound was well healed, massage and movements were started immediately. The patient was discharged eight weeks later with a strong and useful wrist (*Fig.* 549).

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[2] HOFFA, *Verhandl. der Deut. Gesellsch. f. Chir.*, 1898, Pt. i, 156.
[3] COURTIN, *Gaz. hebd. des Sci. méd. de Bordeaux*, 1905, Oct. 8, 481.
[4] COTTON AND BRICKLEY, *Ann. of Surg.*, 1912, March, 368.

MULTIPLE PAPILLOMATA OF THE SMALL INTESTINE CAUSING RECURRENT INTUSSUSCEPTION IN AN ADULT.

By ZACHARY COPE, London.

A youth, age 21, was admitted to St. James's Hospital, Balham, in November, 1921, with a history of occasional attacks of violent abdominal pain. On account of the pain his appendix had been removed at another hospital. After admission he suffered from attacks of severe generalized abdominal pain and vomiting. Between the attacks nothing abnormal could be found in the abdomen. My colleague, Dr. C. E. Lakin, was fortunate to see the patient during one of the attacks, and detected visible peristalsis. On his suggestion I explored the abdomen on Nov. 21. I found many coils of small intestine firmly adherent to the scar of the appendix-incision, and apparently causing some obstruction. The adhesions were freed with some difficulty and the abdomen was closed.

Early in the morning of Nov. 27, he was taken with acute paroxysmal abdominal pain, and vomited much bilious material. The bowels had been regularly opened until the day of this attack, but no return came from an enema given after the onset of the pain. When the paroxysms occurred the patient became pale and collapsed, and it was soon clear that some further interference would be necessary. Abdominal examination showed a large tender lump in the left iliac fossa. There was little difficulty in arriving at a diagnosis of acute intussusception. The abdomen was opened by a paramedian incision and an enormous intussusception was found filling the left iliac fossa and the whole of the pelvic cavity. The pelvic portion was almost impacted in the pelvis. The diameter of the intussusception was between four and five inches, and the portion of gut involved was the middle of the small intestine. Reduction was not difficult, and, when reduced, the affected part of gut was seen to be many feet in length. Search was made for a tumour which might have caused the condition, and some soft lumps were felt in the bowel in that portion which had formed the apex of the invagination. These lumps were very soft and movable, so one concluded they might be inspissated content of the bowel, and closed the abdomen without further investigation.

The patient progressed favourably until the thirteenth day after the operation. Early in the morning of Dec. 10, however, he was seized with another attack of acute abdominal pain, with vomiting and collapse. In a few hours a lump was felt on the left side of the abdomen similar to that felt previously. An additional observation on the second occasion was hyperæsthesia of the left iliac and left anterior lumbar regions.

Operation was promptly undertaken and an almost exactly similar intussusception was again discovered, with the addition that there were many fresh adhesions between the congested intestine and the abdominal wall in the left iliac and lumbar regions. Reduction was on this second occasion much more difficult, but was accomplished with only a few tears of the peritoneal coat of the bowel. The same soft lumps were felt in the bowel at the apex of the invagination, so the gut was incised and one was removed. It proved to be a pedunculated papilloma. It was decided to remove the other swellings on a future occasion, so the abdomen was closed. Six days later, when the abdomen was re-opened, very many soft and fresh adhesions made the operation extremely difficult ; but the former apex was identified and two more papillomata were removed by enterotomy. No more tumours could be detected, but there may have been other minute papillomata which could not be felt. Resection was out of the question, since there were many extensions, the gut was very inflamed, and one did not know the extent to which it might be affected by the papillomata. The convalescence of the patient was uneventful, but the prognosis can not be regarded as altogether satisfactory, although microscopic report on the tumours pronounced them to be non-malignant.

This case is recorded for three reasons :—

1. Papillomata of the middle segment of the small intestine are very rare.
2. Intussusception of the middle portion of the small intestine is excessively rare.
3. The tumour formed by the intussusception was unusually large, and filled the pelvis like an impacted tumour.

A Small Point in the Technique of Reduction of an Intussusception.

As a rule no difficulty is experienced in the reduction of the main part of an intussusception by the accredited 'expression' method. There is often great difficulty, however, in the reduction of the last portion. Judging by the great mortality and numerous resections recorded in some published series of cases, any slight assistance in reducing this difficult last portion deserves to be recorded. One need hardly apologize, therefore, for publishing a small manœuvre which I have practised for some years and found of great value in assisting the reduction of the last part of the invagination.

FIG. 550.—Showing little finger inserted into the sulcus between the entering and returning layers of the intussusception. Adhesions between the two peritoneal surfaces are thereby freed.

FIG. 551.—Drawing to show how œdema is expressed from the swollen wall of the bowel.

The procedure consists in introducing the little finger between the entering and returning layers of the intussusception (*Fig.* 550). It is largely due to the adhesions or friction between the two peritoneal surfaces of the intussusception that reduction is difficult. As a rule, no difficulty is experienced in inserting the little finger into the sulcus. By this means some of the œdema may be expressed (*Fig.* 551), and any adhesions freed, or blood cleared. After that has been done a renewal of the usual method of reduction can be undertaken ; in some cases it is even justifiable to exert a certain amount of traction on the proximal segment of gut so long as the entering and returning layers have been well separated.

I believe if this little manœuvre is tried in any difficult intussusception there will be very few occasions—apart from actual gangrene of the gut—in which resection will be needed. In the case described above, the method was found of use on the second occasion when reduction was difficult.

VISITS TO SURGICAL CLINICS AT HOME AND ABROAD.

THE CLINIC OF PROFESSOR RAFFAELE BASTIANELLI, ROME.

THE great General Hospital of the city of Rome, the Policlinico, is a modern institution built on the pavilion system. Professor R. Bastianelli, who has charge of one of the surgical services in the Policlinico, owes his excellent English to his American wife. His partiality for the Anglo-Saxon race shows itself in the genuine pleasure and hospitality

FIG. 552.—The Royal Institute of Clinical Surgery, Policlinico, Rome.

with which he welcomes British surgeons to his clinic. We found that his admiration for British surgery was of no recent growth, but had given rise to an innovation in nursing in Rome which is destined to produce far-reaching consequences.

Rather more than ten years ago, Professor Bastianelli, who had long been impressed with the inferiority of the nursing in Italian hospitals as compared with British or

American, formed a private Committee, consisting of the Princess Doria Pamphrity, Marchesa Maraini Gonzaga, and himself, to consider a project for introducing into Italy the English nursing system. As a first step it was decided to build a Nurses' Home in the centre of the Policlinico. The Committee obtained the patronage of H.M. the Queen of Italy, and with her help and with that of the hospital managers and the Prime Minister, Signor Giolitti, the Home was built, and opened in April, 1910. An English matron, Miss Dorothy Snell, was appointed, and she brought with her twenty English sisters and nurses. Ten Italian probationers were added to this service for purposes of training; two pavilions in the Policlinico, one surgical and one medical, were staffed with this personnel, and the experiment began.

The course of training for Italian probationers was at first two years in duration. In 1912 Italian certificated nurses trained in this service began to take the places of some of the English nurses, and in 1914 the first Italian sister was appointed. In 1916 it was found necessary to extend the course of training to three years.

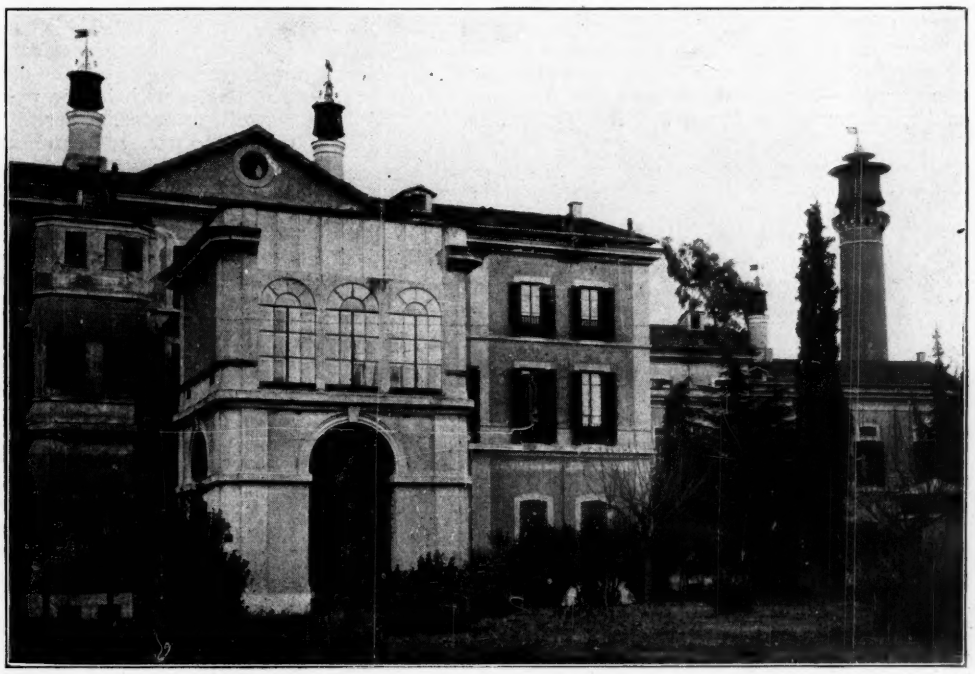

FIG. 553.—The Nurses' Home at the Policlinico.

In its early days this innovation encountered much local opposition. There were many who did not share Professor Bastianelli's dissatisfaction with the standard of native Italian nursing then prevalent, and who regarded bed-sores in most serious cases as an act of God rather than as the result of incompetent nursing. Vested interests were, of course, aroused, and the drum of local patriotism was beaten loudly in opposition to these alien invaders. But the diligence, ability, and tact of the Matron and of her staff little by little succeeded in making the new School of Nursing a great success, and its fame spread to such an extent that, during the war, often the first request of a wounded Italian soldier on being transported to Rome was to be sent to the 'English Pavilion'. To-day the staff is almost entirely Italian; the only remaining English people are the Matron, Assistant Matron, and a night sister. There is a nursing staff of about 80 on duty in the units concerned, of whom 12 are sisters, and if it were not for the difficulty of displacing the former untrained men and women nurses, and the agitation of certain political organizations behind them, the School would have made still greater headway.

That the experiment is a successful one is proved not only by the fact that the pavilions staffed by the School nurses have been recognized by the authorities and by doctors as the best in Italy, but also by the conclusion of a Royal Commission appointed to study the problem of the nursing service in Italy. The Commission concluded that the Scuola Convitto Regina Ilena in Rome should be taken as the standard for future Schools to be founded in Italy.

Professor Bastianelli's operating theatre is rather small, with excellent light. The theatre staff consists of 1st assistant (a 'long-service' man), 2nd assistant, instrument sister (an Italian, trained in the British tradition by the sisters brought over by Bastianelli eleven years ago), probationer, and male theatre attendant. The general aseptic technique is on usual modern lines. Alcoholic solution of picric acid is used for sterilizing the skin, and smooth rubber gloves are worn.

On the morning of our visit, the Professor operated on four cases, and the details of his technique are described in the following paragraphs.

Case 1.—**Carcinoma of pylorus: partial gastrectomy.**

The patient, a man, gave a history of a sense of weight and pain in the epigastrium for four or five months, and there was a large movable tumour in the right epigastrium.

OPERATION.—A mid-line incision was made above the umbilicus. The growth in the pyloric end of the stomach was large, but fairly movable. Professor Bastianelli, after some hesitation, decided to remove it, and began the gastrectomy at the cardiac end. He first tore through the small omentum, and placed two heavy Spencer Wells' forceps on the coronary artery about one-third of the distance down from the cardiac orifice to the pylorus. The coronary artery was divided between these and tied with catgut on a transfixion needle. The left end of the great omentum was then divided between Kocher's forceps, and tied off with catgut, which gave a good deal of trouble by breaking. Two curved gastrectomy forceps were next placed on the stomach high up to the left, one inch apart, and—after packing off—the stomach was divided by knife between them, close to the lower clamp. The exposed mucosa was swabbed with tincture of iodine. The rest of the great omentum was next divided between Kocher's forceps and tied off, and the stomach turned down to the right, exposing its posterior wall. The posterior aspect of the growth was freed from the pancreas by the method of scissor dissection so often employed by our gynæcologists. The pyloric vessels were divided between forceps. At this point there was rather severe hæmorrhage from either the gastroduodenal or splenic artery, which took some little time to control. The first part of the duodenum was now divided between clamps. The Professor contemplated a direct union of the divided duodenum with the stump of the stomach, which is apparently his favourite method. After testing the mobility of the two parts, however, he decided that he had stripped the posterior wall of the duodenum too much, and left it too thin to hold sutures under some tension. Accordingly, he abandoned the idea of a Billroth gastrectomy, and decided on the precolic Polya method. The duodenum was closed in two layers with catgut. A straight needle was used for the hæmostatic suture, and a curved needle with interrupted sutures for the Lembert. Curved clamps without rubber covering were applied longitudinally to the first loop of jejunum. (The clamps left on the stomach stump were rubber-covered.) The proximal end of the jejunal loop was approximated to the greater curvature of the stomach, and the distal end to the lesser curvature. For the seromuscular stitch, silk on a curved needle was used. It was carried along the whole length of the posterior wall of the stomach and clamped jejunal loop, and tied off. The lumen of the stomach was now reduced by a second Lembert stitch of silk

FIG. 534.—Professor Raffaele Bastianelli operating.

carried half-way up from the greater curvature, so as to make a stoma half the size of the gastric lumen, lying close to the lesser curvature. An incision of corresponding size was made in the upper (distal) half of the jejunal loop. The through-and-through hæmostatic suture was catgut on a straight needle. He began it at the lower end on the greater curvature, as a continuous Lembert. On reaching the lower end of the stoma it became a continuous through-and-through stitch, and so up to the lesser curvature. For turning the corner, and for the anterior layer, it became a mucous loop stitch, and at the lower angle of the stoma was carried on again as a seromuscular to meet its commencement at the greater curvature, where it was tied off. The clamps were now removed and the anterior layer of the original seromuscular suture of silk was brought down the whole distance from the lesser to the greater curvature.

In closing the abdominal wall four interrupted tension-stitches of thick silk were passed through all layers including peritoneum, and left temporarily untied. A row of interrupted catgut was used for peritoneum and linea alba, and continuous catgut on a curved needle for the skin. The four tension-stitches were finally tied over a roll of gauze.

The whole operation took one hour and forty minutes. We learned two days later that the patient was makng a good convalescence.

Case 2.—**Duodenal ulcer.**

A right paramedian incision was made, and a typical ulcer in the first part of the duodenum exposed. The ulcer was not excised but was infolded with interrupted catgut. Posterior gastro-enterostomy was performed, and curved, interlocking clamps uncovered by rubber were employed. A rather long jejunal loop was left above the stoma. For the outer layer silk on a straight needle was used. The Professor mentioned that he did not believe that silk or other non-absorbable stitch is the chief cause of gastrojejunal ulcer. On opening the stomach, vessels in the submucosa were picked up by artery forceps before the mucosa was laid open. The anterior layer of the hæmostatic stitch was inserted as a mucous loop. The stitching was very close, approximately twelve to the inch. A straight needle was used for both layers. The stoma was placed horizontally on the posterior wall of the stomach, and the mesocolon sutured to the stomach close to the anastomosis at the completion. The abdomen was closed without inspecting the gall-bladder, appendix, or other organs.

FIG. 555.—In the operating theatre.

We noticed later that other surgeons in Italy very commonly omitted the wide general inspection of the abdominal viscera that is considered so desirable by British and American surgeons, and were content to deal with the main lesion alone.

Case 3.—**Carcinoma of the left testis.**

There was a four months' history of swelling. With the patient in the half Trendelenburg position a groin incision was made, extending from the upper scrotum parallel with Poupart to above the anterior superior spine. The external oblique was slit up from the external ring, and the cord isolated and clamped at the level of the internal ring before the tumour was manipulated. The incision was now carried down on to the scrotum, and the testis (which was very large) dissected out of the scrotum. The abdominal incision was then prolonged up on the outer side of the linea semilunaris to the left costal margin. The muscles were divided, the peritoneum was raised from the lateral and posterior abdominal wall, and retracted towards the mid-line. The vas was separated from the spermatic vessels and divided. The spermatic vessels were traced high up towards the aorta and divided. No enlarged glands were found, but two or three apparently normal glands were removed from along the aorta. The wound was then closed, the only drainage being a small tube into the subcutaneous tissue of the inguinal region.

Case 4.—**Gall-stones.**

The patient was a woman with a typical history of biliary colic and jaundice.

The incision was vertical through the outer part of the right rectus, and the upper end was

prolonged obliquely upwards and inwards, parallel with the costal margin. Tongue forceps were used to grip the gall-bladder. The cystic and common duct were dissected out with long curved scissors; cholecystectomy was performed, starting by a division of the cystic duct and artery, and the gall-bladder fossa on the liver was covered in by interrupted catgut stitches. Before ligaturing the cystic duct, a flexible probe was used to explore the common and hepatic ducts, which were free from stones. A split drainage tube, with a gauze wick, was left in the sub-hepatic fossa.

Dr. Sgambati, the pathologist in Professor Bastianelli's Clinic, described to us a test for perforative peritonitis which they had used empirically for some time, and to which they attached considerable importance. Into a test-tube containing the patient's urine, strong nitric acid is poured as in the ordinary test for albumin, and if the test is positive a brownish-purple colour appears above the nitric acid for some depth. He stated that it was never found in intestinal obstruction alone; that it appears within two hours after perforation of an abdominal viscus; but there is a slight reaction the day after any abdominal operation. The chemical significance of the test is not understood.

The writer was fortunate enough to attend one of Professor Bastianelli's classes in clinical surgery. The patient was on a couch in the centre of a large lecture theatre, the Professor sat in a chair by the side of the patient, and two students were called down to examine the case. There were a hundred and twenty students in the class, nearly all men. The patient had a large ovarian cyst, and the Professor made the two students go through the ordinary physical examination, discoursing to the class at intervals upon the precise significance of the various methods of physical examination, and then upon the differential diagnosis, pathology, and treatment of the condition. Whether the Italian medical student is a more tractable individual than his British *confrère*, is a matter of uncertain speculation; but it is an undoubted fact that Professor Bastianelli held his large class of students in a state of active attention during the whole of his dissertation, and it was a remarkable proof of this interest that the percussion notes were perfectly audible at the back of his large audience.

SHORT NOTES OF RARE OR OBSCURE CASES.

INVERSION OF THE VERMIFORM APPENDIX.

By ARTHUR EVANS, London.

A female, age 33, was admitted into hospital Sept. 29, 1919.

History.—The patient stated that she had been losing weight for the previous twelve months. For the first six months of that time her periods came on every fourteen days, and each period lasted till the beginning of the next. For the last six months she had been quite regular, each period lasting from five to seven days.

She had suffered no abdominal or pelvic pain; the bowels were regular, and she had sought admission into the hospital solely on account of the loss of blood and loss of weight.

On Admission.—A slight swelling could be felt above the pubes. Vaginal examination revealed a swelling in Douglas's pouch.

Operation.—At the operation the contents of the pelvis were found matted together. The bladder was closely united to the uterus, and the line of junction was hidden by a firmly adherent coil of small intestine. These structures were freed, and the Fallopian tubes and ovaries identified. These were fused into one thickened and adherent mass. On the left side an abscess cavity was opened.

Both tubes and ovaries were removed. At the conclusion of the operation, as a matter of routine, the cæcum was drawn into the wound and inspected, when it was discovered that the appendix was inverted,

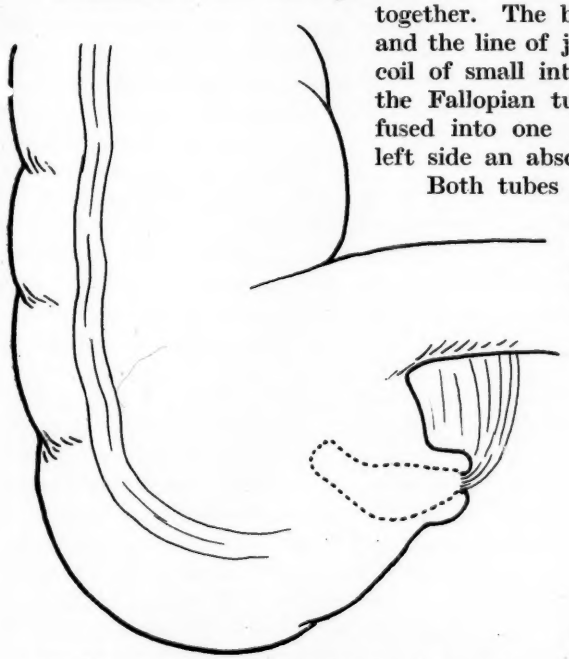

Fig. 556.—Showing the position of the inverted appendix at operation.

Fig. 557.—The appendix, showing congestion of the mucous membrane. (*Natural size.*)

presenting the appearance shown in *Fig.* 556. The tip could be felt within the cæcum. The inversion was not reducible.

The meso-appendix was clamped and cut, and a circular incision made round the base of the appendix; when this was done the appendix became wholly inverted (*Fig.* 557). This specimen is now in the museum of the Royal College of Surgeons.

The distal half was congested, and at the extreme tip hæmorrhage had taken place into the tissues.

No history was obtained referable to trouble with the appendix.

DUPLICATION OF THE URETER.

By GEOFFREY KEYNES, London.

Duplication of one or both ureters is not a very uncommon condition, though the abnormality is more often incomplete than complete. Different authorities have estimated that a double ureter occurs in from 1 to 4 per cent of all diseases of the urinary system. In many cases the condition is only discovered at autopsy, having given no trouble during life. In the following case the patient's illness, which was directly due to this abnormality, ran a very obscure course, and an unusual state of affairs was revealed after death.

The patient was a single woman, age 26. Previously she had always enjoyed good health; but one month before admission to hospital had noticed a swelling in the left side of her abdomen. This swelling had increased in size and become tender. For several days she had felt feverish. On examination, a large cystic tumour was felt in the left hypochondrium extending from the costal margin to three inches below the umbilicus. The tumour was thought to be of renal origin, but in the absence of any other signs or symptoms, no certain clinical diagnosis could be made. An exploratory laparotomy was performed by Mr. G. E. Gask; but the tumour, extending from the left dome of the diaphragm to the brim of the pelvis, was found to be too large for removal. The fluid contained in it was accordingly evacuated, three pints being obtained, and the cavity was drained through the abdominal wall. An examination of this material threw little light on the nature of the tumour. It was a thin turbid fluid containing many pus cells, some red blood-cells, and a few doubtful Gram-negative micro-organisms. No growth was obtained on culture. The urea content was estimated by Dr. George Graham, and was found to be 55 mgrm. per cent—an amount such as would be found in any of the body fluids. It seemed improbable, therefore, that this fluid was of renal origin, and the diagnosis remained obscure. After the operation the general condition of the patient became steadily worse, and she died after three days with all the symptoms of a profound toxæmia, with incessant vomiting, and very scanty urine which contained much acetone.

The post-mortem examination revealed an interesting condition. All the organs were found to be normal except the urinary tract on the left side. The lower part of the left kidney appeared normal, and a normal ureter proceeded from the hilus. The upper part, however, was occupied by the large cyst which had been tapped at the operation, and was now much reduced in size. From this proceeded a second ureter, dilated and tortuous. The lumen of this communicated with the cyst above, but it was obliterated at several points in its course within the pelvis, so that it was represented by a series of distended loculi, all of which contained a considerable amount of thick yellow pus. One of the loculi had bulged between the layers of the broad ligament and was in contact with the left side of the uterus. The loculus below this was in intimate contact with the wall of the bladder: it penetrated the muscular layers so that its wall was only separated from the lumen of the bladder by the mucous membrane; but there was no indication that it had ever possessed any opening through this. The point of closest contact with the mucous membrane of the bladder was a little below and in front of the opening of the normal ureter. Further loculi extended into the substance of the wall of the vagina, but again without opening into it, and there was no evidence that any such opening had ever existed. The accompanying drawing (*Fig.* 558), made from a dissection of the parts, shows the course and relations of the second ureter.

The patient, therefore, had a complete duplication of the ureter on the left side, but the upper or abnormal ureter had never communicated with the bladder or any other part of the genito-urinary tract. A hydronephrosis of the upper part of the left kidney had resulted, and this, presumably, had been present since birth. At the same time the abnormal ureter had become dilated and tortuous, and adhesions forming within its lumen had divided it up, in the course of time, into a series of loculi. This suggests that a chronic infection of the tract, possibly travelling through the wall of the vagina, had been present for many years, but of so mild a degree that the patient believed herself to

be in good health. In the end, however, the infection assumed a more virulent character, so that the ureter was converted into a series of abscesses. At the same time there was a great and rapid increase in the amount of fluid in the cyst which represented the upper pole of the left kidney. All trace of kidney tissue, however, had disappeared, probably long before, from the walls of the cyst, and consequently the fluid secreted no longer resembled urine in its chemical constitution. Drainage of this hydronephrosis did not relieve the patient, who possessed a number of other pus-containing cysts in situations unsuspected and difficult of access. Death from toxæmia was accordingly the natural termination.

The abnormality conformed to the type most commonly found, in that it was on the left side, and involved the upper pole of the kidney. Usually, however, the additional ureter has an opening below into the bladder, vagina, or urethra, whereas in the present case there was no opening, so that a hydronephrosis inevitably resulted. Even when the opening is present a hydronephrosis may nevertheless develop. A case of incomplete duplication of the left ureter with intermittent hydronephrosis followed by pyonephrosis was recently recorded by Pizzetti.[1] An interesting specimen, which has not been described in the literature of the subject, is preserved in the museum of St. Bartholomew's Hospital. This was obtained from a man, age 50, who died from cerebral hæmorrhage. Both ureters are completely duplicated, and all four open into the bladder, but the more posterior ureter on each side has formed a considerable pouch in the wall of the bladder and is dilated in its whole length. On the left side the abnormal arrangement has caused some obstruction to the outflow from the second ureter, so that both are dilated and the kidney is hydronephrotic in addition. The same has occurred to a much slighter degree on the right side.

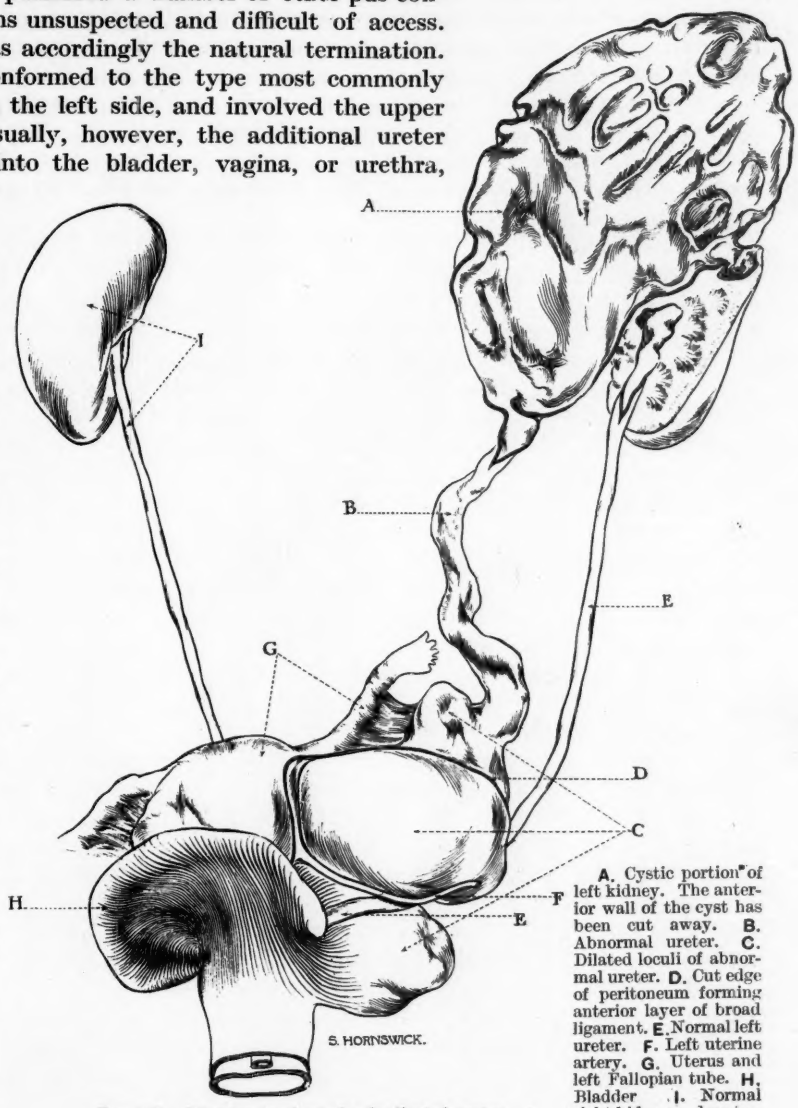

FIG. 558.—Diagram to show the duplicated ureter.

A. Cystic portion of left kidney. The anterior wall of the cyst has been cut away. B. Abnormal ureter. C. Dilated loculi of abnormal ureter. D. Cut edge of peritoneum forming anterior layer of broad ligament. E. Normal left ureter. F. Left uterine artery. G. Uterus and left Fallopian tube. H. Bladder. I. Normal right kidney and ureter.

Hydro- and pyonephrosis is, therefore, not a very rare complication of double ureter, but it is unusual for the patient to die as a result of this alone, and the condition may be exceedingly difficult to diagnose.

REFERENCE.

[1] *Policlinico* (Sez. Chir.), 1921, April 15.

EXOPHTHALMIC GOITRE: DEATH FROM BILATERAL FEMORAL THROMBOSIS AND GANGRENE.

By W. G. SPENCER, London.

A female typist, age 21, was admitted to the Westminster Hospital on Sept. 17, 1917. She had had a gradually increasing swelling of the thyroid gland for three years, and had lost over a stone in weight during the last few months. She had become breathless when going upstairs and had occasionally awaked at night with distress in breathing. But she had not been troubled by palpitations or by difficulty in swallowing.

The thyroid gland was uniformly enlarged, and firmly elastic; its margins were not well defined, but it moved with the larynx. There was marked bilateral exophthalmos, with von Graefe's sign present. The pulse was feeble and irregular, averaging 108. No cardiac murmurs could be heard.

The patient was kept in bed from Sept. 17 to 28; she showed nervous excitement, and blushed on slight provocation. The pulse-rate continued unaltered at 108, the temperature rose at night to 99·5°. She was very restless at night, and also by day. The bowels acted regularly. The urine was normal.

Sept. 28.—About three-quarters of the right lobe of the thyroid was removed, and also the isthmus. There was no excessive hæmorrhage. The depressor muscles were united, as well as the skin, except for a small tube removed on the following day. The operation appeared to be well borne, but for the next three days the patient was extremely restless in spite of drugs, bromide and chloral, and morphia.

Sept. 30.—The wound was dressed and looked perfectly well—pulse-rate 120, temperature 99°.

Oct. 1.—The fourth day after the operation, the left leg was painful and cold, with marbled skin; there was no pulsation in the dorsalis pedis or in the popliteal artery, but the left common and superficial femoral could be felt pulsating for at least three inches below Poupart's ligament.

Oct. 2.—The right lower extremity was in the same state as the left had been on the previous day. Pulsation in the left femoral artery could only be felt just below Poupart's ligament.

Oct. 3.—The left leg presented several separate patches of skin becoming gangrenous.

Oct. 5.—The right leg showed patches of commencing gangrene.

Oct. 6.—On the left side pulsation could be felt for one inch below Poupart's ligament; on the right side scarcely any pulsation could be felt in this place. Both limbs were quite cold up to the knee, above which the circulation seemed sufficient. There was no voluntary movement in the toes or legs. Deep pressure at the ankle could be felt. There were dark purple, dry, and hard gangrenous patches of skin on both sides as high as the knees.

Oct. 7.—There was no pulsation below Poupart's ligament on the right side; slight pulsation in the left common femoral. The patient had continued very restless, the pulse and temperature remaining unchanged. The operation wound had healed.

Oct. 8.—As the patient began to die the temperature rose, the patient continuing restless to the end.

Post-mortem Examination.—This took place twelve hours later, and revealed the following conditions:—

Heart.—The left ventricle was hypertrophied. All the four chambers were filled with agonal clot. In the left ventricle near its apex there was a granular, adherent ante-mortem clot, the size of an almond.

Lungs.—These were slightly congested, but otherwise normal.

Kidneys.—Infarctions were found in both kidneys, recent on the right, old on the left side.

Lower Extremities.—Thrombosis was present in the femoral arteries and veins of both sides. In the right common femoral artery the clot was moderately firm, pale, and extended upwards to the bifurcation of the common iliac. The clot on the left side was softer and more red.

Examination of the Portion of Goitre Excised.—The tissue was composed of small follicles; there were only a few large ones. The small follicles were mostly devoid of colloid, the larger were filled with it. The follicles had mostly cuboidal epithelium, although in places it was columnar. The interfollicular tissue was of moderate density.

SEVEN LARGE SEWING-NEEDLES IN THIGH.

By W. G. SPENCER, London.

The following case depended for its successful issue wholly on radiography. A man complained of pain in the right thigh, but there was nothing to be seen or felt. The radiograph reproduced (*Fig.* 559) was taken by the sister acting under Capt. Robert Knox. It was thus discovered that there were seven large sewing-needles, each nearly two inches in length, in the quadriceps extensor muscle, about the middle of the thigh, external to the line of the artery. All had been pushed in, with their points directed upwards, almost in the course of the muscle fibres, until the eye ends were well beneath the aponeurosis. A curved flap of skin and subcutaneous tissue was turned up, corresponding to the anterior flap of an amputation, which exposed the aponeurosis overlying the needles. Even then no needle could be felt. The sister, however, by means of the screen, fixed the situation of the eye end, so that each needle in turn was reached by a mere puncture through the aponeurosis. All were thus quickly extracted; the flap, after being sutured down, healed by first intention, and there was no complication.

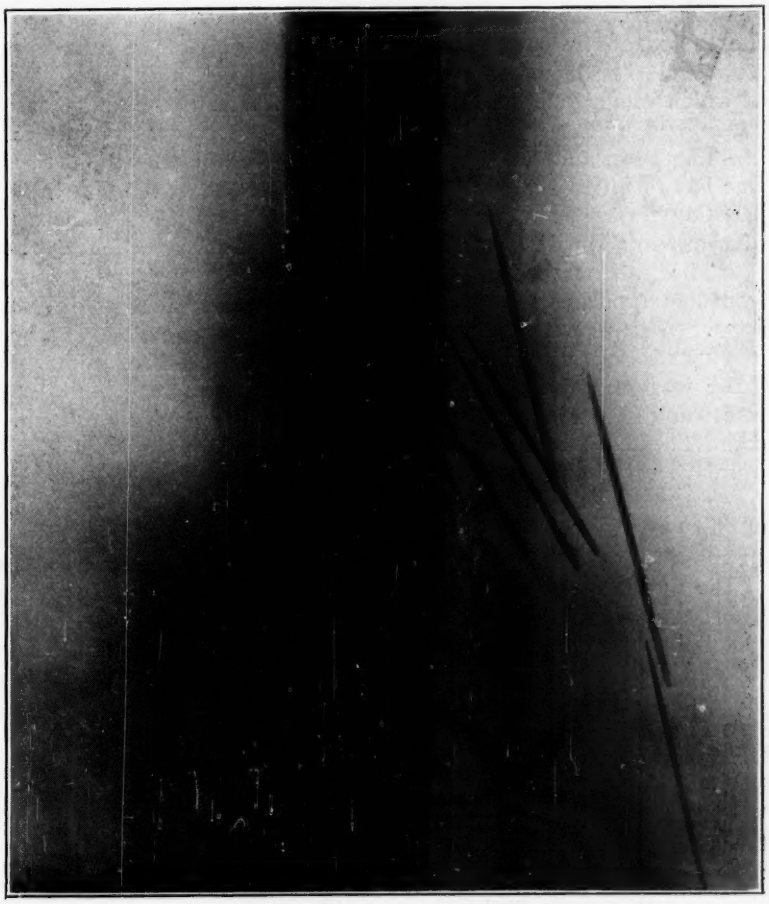

Fig. 559.—Radiograph (lateral view) showing the seven needles *in situ*.

TRAUMATIC ANEURYSM OF SPLENIC ARTERY—RUPTURE—LIGATURE.

By C. JENNINGS MARSHALL, London.

The following case is that of a revolver bullet wound of the abdomen.

X. Y., a married woman, age 27, was admitted to hospital on Jan. 25, 1921, with the history that she had accidentally wounded herself while cleaning a revolver.

She was very restless and pale; temperature 96·4°, pulse 102, and respiration 32. Immediately below the tip of the xiphoid, one inch to the left of the mid-line, was a small circular wound, depressed, and with slight blackening. There was no external bleeding. The upper abdomen was slightly rigid, and tender to pressure. No dullness was made out on percussion.

Laparotomy was performed; a left rectus-splitting incision was employed, excising the entrance wound. The track of the bullet was made out in the successive layers, and when the peritoneum was opened, with the escape of five or six ounces of blood, was seen to pass through the left lobe of the liver; from entrance and exit came a moderate venous ooze, easily arrested by mattress sutures. Deep to the liver was a perforation of the gastrohepatic omentum, the merest fraction of an inch from the lesser curve of the stomach. The lesser omental cavity was opened and found also full of blood, the source of which was a hole drilled in the upper border of the pancreas, which was oozing slowly. There was no fat necrosis. A few superficial sutures of fine catgut were used to arrest bleeding here, and to close the opening in the gland with peritoneum. A cigarette drain was left down to the hole in the gland, and the abdominal incision was closed.

Convalescence was complicated by a pancreatic fistula which caused great soreness of the skin: on discharge to a convalescent home in March the fistula had just closed.

The patient was re-admitted on May 11. For three weeks she had been suffering from left hypochondriac pain, which had increased to a great extent during the past three days. With this there was increasingly urgent vomiting. The patient had a strained, exhausted look, retched or vomited every two or three minutes while under observation. Pulse was 112, and very weak; temperature was 101·8°, and respiration 32. The wound was soundly healed, and devoid of the appearance of inflammation. A distinct bulge could be seen in its lower part. The epigastrium was rigid and very tender. A suppurative process in the pancreas or in a pancreatic cyst was suspected.

Laparotomy, May 12.—The old scar was cautiously incised. On the deep surface of the parietes was found a rounded immobile tumour the size of a closed fist, attached to the abdominal wall in front by loose adhesions. A pack was placed at the lower part of the incision where a small opening had been made into the general peritoneal cavity. The tumour was then entered by blunt dissection; immediately a mass of recent dark blood-clot was extruded, followed by unclotted blood, and there was seen to be fierce arterial bleeding from the extreme depths of the cavity. By finger-pressure downwards, at what appeared to be the upper border of the pancreas, it was possible to control the flow completely. The patient was becoming very collapsed, and access to the source of the blood was almost impossible, owing to the narrowness of the costal arch, the heavy build of the patient, and the dense adhesions. It was very reluctantly decided to resort to the temporization of packing. Flavine-soaked gauze was packed firmly on to the bleeding point, and the cavity filled with similar material. The wound was partially closed round this.

The patient made a good recovery from the operation, though there was much pain and vomiting for two days. The gauze kept superficially clean and bloodless, and the evening temperature settled down to 99·6°. On the eighth day, however, there was another attack of vomiting, disarranging the pack, and profuse arterial soaking of the dressing resulted. It had been clear that the only chance of recovery lay in ligature, and this was now forced upon one.

Laparotomy.—The stitches were removed, the incision was extended, and protective packs were inserted. The gauze was removed cautiously—in its superficial part it was quite clean, but the deep part in contact with the pancreas was foul. Again the fierce bleeding occurred, and was at first arrested by digital pressure. The pack had enlarged the cavity so that access was somewhat easier, and now, by the aid of strong retraction, it was found possible to get direct vision of the field. The bleeding was next controlled by the proximal pressure of a swab on a long holder against the cœliac axis, and was seen to come from a hole in a mass of inflammatory tissue at the upper border of the pancreas. Dissection by long, blunt-pointed scissors exposed the splenic artery at the bottom of this: there was a true aneurysmal sac the size of a green pea, ruptured at the left side. A stout catgut ligature was introduced on the proximal side and tied; the effectiveness of the anastomotic circulation was tested by release of the swab on the cœliac axis—the distal end of the vessel emitted a weak arterial spouting of blood, and was tied in a similar manner. Splenectomy, however, was not performed in view of this distal flow. The large cavity was lightly packed with flavine gauze, and the wound partially closed. There was considerable post-operative collapse: the control of bleeding, though vital to a clean exposure and ligature of the vessel, had been far from perfect—the assistant surgeon necessarily could not see what he was doing with the compressing swab-holder, and slipping was frequent; the point of compression, too, was uncomfortably near the site of bleeding.

A satisfactory recovery, however, was made; the wound was frequently irrigated with flavine, and the gauze changed daily. The cavity was slow in contracting, and pancreatic leakage was again evident. Pain and vomiting were absent after this operation, appetite and colour returned, and the evening temperature had dropped to 100°, when on the sixteenth day there was a rigor with a temperature of 104°, and severe pain at the left costal margin. The left upper abdomen was rigid and exquisitely tender. The condition of the wound had not altered in any way; no enlargement of the spleen was to be made out nor any abnormal dullness in the lower costal or hypochondriac region. Sir J. Charlton Briscoe kindly examined the patient and reported that there was no pleurisy, and no change in the lung except slight basal collapse. Three days later the condition was substantially unaltered save that it was thought there was slight dullness extending towards the left costal margin; the leucocyte count was 15,400. Some form of infection of the spleen had been thought likely (necrosis did not seem probable in view of the lapse of time, and of the condition of the distal circulation at the last operation), but now a subphrenic abscess, possibly secondary to splenic infection, was favoured.

Operation, June 9, 1921.—A left subcostal incision was made half an inch from the costal margin. Packs were inserted on opening the peritoneum and an abscess was opened, just reaching the edge of the ribs. About six ounces of thin pus was evacuated, and it was then seen that the cavity extended back and almost completely enclosed the spleen. There was no communication between it and the central wound. The visible splenic surface seemed absolutely normal, and the organ was neither swollen nor shrunken. The cavity was drained from the bottom.

Again rapid improvement was evident. Both wounds closed down to narrow tracks, but drainage was obstinately maintained by corrugated rubber kept down to the extreme depths of each.

Nevertheless a fortnight later there appeared much cough, and the temperature shot up to 102°. Two days later several ounces of pus were expectorated; for four or five days more similar sputum was brought up. From this point progress was uninterrupted, and, on discharge from hospital three weeks later to convalescence, there was only a fine pancreatic fistula at the middle wound.

Health mended but slowly; at the end of three months the patient was getting about fairly well, but the fistula persisted. There were, however, other worries than ill-health, and, throwing away the results of the fortitude with which so much suffering had been borne, she obtained final release, with three others, in a draught of champagne containing much cyanide of potash.

A SACCULUS OF THE URINARY BLADDER WHICH RUPTURED DURING MICTURITION.

By LENNOX GORDON, Capetown.

The following clinical history brings out several points of interest :—

The patient, a male, age 48, was admitted to the New Somerset Hospital under my care in June, 1921, complaining of acute abdominal pain. His previous health appeared to have been good except that he gave an indefinite history of 'occasional' attacks of difficulty in passing water noticed after a 'chill'. He had gone to bed on the night of June 28, feeling quite 'fit', and had risen next morning at 6.20 to pass water. He noticed that he had to strain while getting his water away, and during the act of straining he was seized with sudden acute pain in the lower part of the abdomen. He stated that he was able to finish the act of micturition in spite of the pain, and that he did not notice any blood in the urine.

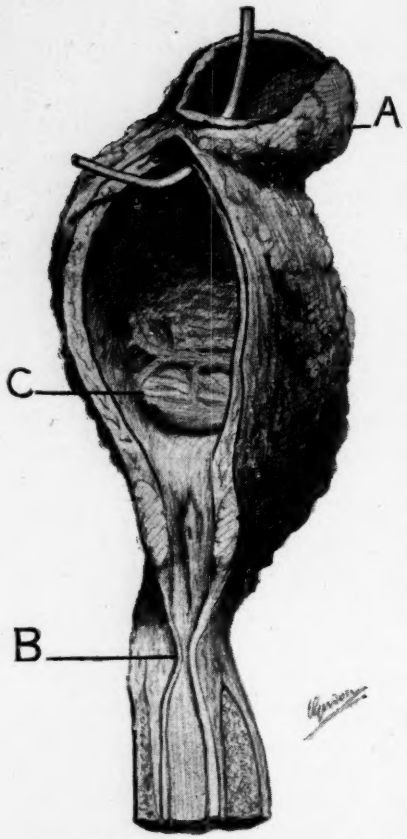

FIG. 560.—Post-mortem appearance of the bladder after removal. The bladder has been opened from the anterior aspect. The rupture of the sacculus has been enlarged in the post-mortem examination. (A) Sacculus with probe passing from bladder into sacculus. (B) Stricture of the urethra. (C) Position of opening of smaller sacculus hidden behind a fold of mucosa.

He remained in bed during the day on account of the pain, but did not call in a doctor until late that night. He vomited once during the day. He was admitted to the New Somerset Hospital in the early hours of the morning of June 30.

The condition on admission as noted by the house surgeon was "that the patient complained of generalized abdominal pain, the maximal point of tenderness on palpation being to the left side of the middle line above the symphysis pubis. He was unable to pass water. A catheter was passed for diagnostic purposes and a stricture was encountered; this was rapidly dilated, and on entering the bladder 26 ounces of blood-stained urine were drawn off. The temperature was 100° and the pulse 96. An enema resulted in a constipated stool with the passage of flatus. After being catheterized the acute pain was relieved, and the patient became more comfortable."

Next morning the symptoms had increased in severity. He vomited twice, and the pulse-rate rose to 120. A laparotomy was performed a few hours later. On opening the peritoneal cavity, blood-stained urine, not in large quantities, was found. There was acute generalized peritonitis. An elongated bladder was found adherent to the anterior abdominal wall, extending up to a point midway between the umbilicus and the symphysis pubis.

Attached to the apex of the bladder was a sacculus which was adherent to the abdominal wall and showed a large ragged rupture on its posterior aspect which opened into the peritoneal cavity. The rupture was one inch long, and irregular in outline. The tear was closed and buried with Lembert sutures. The peritoneal cavity was washed out with saline. A small extraperitoneal opening was made into the bladder above the symphysis for drainage. To drain the bladder by means of a urethral catheter was not attempted, owing to the urethral stricture which, I was told, was a very tight one and difficult to get through with even a small rigid instrument. The peritoneal cavity was closed.

The patient at the end of the operation was very much shocked. The systolic blood-pressure immediately before operation was 105, and at the finish it had dropped to 45. He was immediately transfused with 1 pint of 6 per cent gum arabic solution, and this resulted in the blood-pressure being raised to 120; but the recovery from the shock was only temporary, and the patient died a few hours later.

The points of interest in this case are:—

1. The well-marked sacculus resulting from urethral stricture.
2. The fact that a rupture may occur in a thin-walled sacculus as the result of straining to pass water.
3. The slight degree of involvement of the ureters and kidney pelves as the result of chronic back-pressure.
4. The diagnostic significance of finding 26 ounces of urine in the bladder in which a rupture had occurred.

This point can be explained, I think, by the fact that the rupture was at the apex of a large flabby bladder, and that no overflow of urine had occurred until the bladder had filled itself, the urine being drawn off from the dependent portion of the dilated bladder. The fact that this is the second case of ruptured bladder I have operated on within the past twelve months in which large quantities of urine were drawn off by catheter, shows that an empty bladder is not of such diagnostic importance as one is apt to imagine.

The following Report is taken from the description by Professor Bartlett of the specimen (*Fig.* 560) in the pathological museum of the Cape Town University.

A complication of gonorrhœal stricture of the urethra. Ruptured sacculus at apex of urinary bladder. Gonorrhœal stricture of membranous urethra.

New Somerset Hospital, P.M. No. 25, 1921.

The specimen shows a large sacculus or diverticulum 4 cm. in diameter, with a neck having a diameter of 0·5 cm. projecting from the apex of the bladder. There is a second smaller sacculus on the right-hand side of the base of the trigone. The muscular wall of the bladder is hypertrophied, and there is a narrow fibrous stricture of the membranous urethra. The large sacculus ruptured during life when the man was straining to pass water. He was operated on, and the rupture was sutured, but the patient died of general peritonitis.

The back pressure had not involved ureters or kidney pelves to any marked degree. The wall of the sacculus does not contain muscle: the mucosa and submucosa pouches through a gap between the muscle bundles of the bladder wall. Sacculus formation is common, but rupture of a sacculus is very rare.

My thanks are due to Professor Bartlett for permission to publish the post-mortem notes of this case.

A CASE OF REPEATED ABDOMINAL SECTION FOR INTESTINAL OBSTRUCTION, WITH SOME UNUSUAL FEATURES.

By A. H. BURGESS, Manchester.

On December 23, 1912, I was asked to see, in consultation with Dr. Rothwell, of Hale, Mr. F. S., age 35, who had been seized forty-eight hours previously with acute epigastric pain followed shortly by vomiting, and who was obviously suffering from acute intestinal obstruction, correctly diagnosed by Dr. Rothwell as being due to an intussusception. A swelling could be felt along the course of the transverse colon, ending under the left costal margin. He was at once transferred to a nursing home, where I opened the abdomen through a vertical incision, splitting the fibres of the left rectus; the swelling proved to be an intussusception of the colon. This was reduced with some difficulty, when its apex was found to be constituted by a malignant growth of the transverse colon, arising 4 inches

from the hepatic flexure. With a view to its later removal, I performed lateral anastomosis between the ileum—6 inches from the ileocæcal valve—and the lower end of the descending colon. The incision was closed in layers without drainage, the obstruction was relieved, and the wound healed primarily.

On January 5, 1913, I again opened the abdomen, this time by splitting vertically the fibres of the right rectus, and excised all the bowel between the two portions laterally anastomosed at the first operation, that is to say, the last few inches of ileum, the cæcum, the appendix, and the colon down to the lower end of the descending colon, along with the lymphatic areas of the ileocolic, right colic, middle colic, and part of the left colic arteries: also many enlarged glands were removed with the mesenteries. Both divided ends of the bowel were ligated and invaginated: the wound was again closed in layers, without drainage. The parts removed were examined by the late Professor Delepine, who reported that "The growth is a malignant adenoma, the coats of the bowel being deeply invaded; but the peritoneal coat has not been reached. Three lymph glands have been examined but show inflammatory changes only."

The wound healed primarily, and the patient's condition was very satisfactory until January 28, when he commenced to have recurrent attacks of severe intestinal colic. These persisted, the abdomen became distended and his general state deteriorated so rapidly that three days later I again performed laparotomy, this time in the median subumbilical line. Distended small intestine was traced down to near the site of the ileocolostomy of the first operation, but owing to the extremely grave condition of the patient, the exact cause of the obstruction was not determined, and a lateral anastomosis was rapidly performed between the lowest coil of distended gut and an adjacent collapsed coil of ileum. This relieved the obstruction; the patient recovered steadily, and left the home on February 21.

His general condition gradually improved, and he remained well until June 12, 1915, when at 1 p.m. he was suddenly seized with the most acute epigastric pain, soon followed by vomiting and extreme abdominal distention. He was re-admitted to the nursing home, and I again opened the abdomen through the right rectus below the umbilicus. A large amount of deeply blood-stained serum escaped, and two feet of small intestine were found tightly strangulated under a band close to the ileocolostomy: on dividing the band the bowel showed no signs of recovery, so the strangulated portion which, it is interesting to note, included the lateral anastomosis of the last operation, was resected. The distal line of division of the gut was found to be within an inch of the ileocolostomy, so the distal end was simply ligated and invaginated, the proximal end being implanted laterally into the colon just beyond the site of the ileocolostomy: the wound was closed without drainage. Progress was quite satisfactory until the twelfth day, when, after removal of the sutures, it was noted that the lower end of the wound bulged slightly. On opening up this portion with sinus forceps a black slough was visible, which on extraction proved to be a piece of gangrenous small intestine, 6 inches in length, with the corresponding wedge-shaped portion of the mesentery. Its removal was followed by a gush of fæces, and for several days all the fæces escaped at the wound: the fæcal flow then gradually diminished, and entirely ceased on July 12, the wound healing by granulation. He returned home, but on August 6 was again admitted with severe colic, vomiting, and extreme abdominal distention. I opened the abdomen for the fifth time—through the left rectus below the umbilicus—and found a coil of small intestine adherent to the mesentery and sharply kinked. The adhesion was of recent formation, and was easily separated with the finger, the obstruction being at once relieved. On this occasion, as the general condition of the patient was fairly good, and bearing in mind the previous history of the case, I made a careful examination of the viscera. With the exception of the adhesion which had caused the recent obstruction, the abdomen was absolutely free from any trace of adhesion. Search was made to discover the site in the gut whence the gangrenous portion had been eliminated after the fourth operation; but so completely had Nature restored the continuity of the bowel and mesentery, that one could not say definitely where it had been previously interrupted. Remembering that the cause of the

original obstruction was a malignant growth, I searched for signs of recurrence, but the only suspicious element was a single enlarged gland close to the site of the ileocolostomy : I removed this gland, but on histological examination by the late Professor Delepine it showed inflammatory changes only. The wound was closed in layers without drainage ; the patient made a quick recovery, and returned home on August 24. Since then he has remained free from obstruction, and at the present time, nine years after the first operation, is in good health : the lower abdominal wall presents five parallel vertical scars, but is quite firm.

The chief feature of interest in this case is in connection with the spontaneous elimination of the gangrenous piece of gut twelve days after the fourth operation. The wedge-shaped portion of mesentery attached to it suggests some circulatory disturbance as the cause of the gangrene—probably embolism or thrombosis of one of the smaller mesenteric arteries, and the various intestinal resections and anastomoses that had been performed must have materially affected the circulation to the remaining gut. For some days, the gangrenous intestine must have served passively to conduct the fæcal current without producing any symptoms of obstruction. After its spontaneous separation the two ends of the bowel must have come into almost exact apposition and formed a perfect ' end-to-end ' union. Considerable adhesions must have been present at this time, fixing the bowel to the peritoneal aspect of the wound and shutting off the general peritoneal cavity, and yet two months later, as disclosed at the fifth operation, not only had the bowel loosened itself from the inner aspect of the wound so completely as to leave no trace of having ever been adherent there, but the union of the ends of the bowel and mesentery had been so perfect that its site could not be detected.

This reparative effort on Nature's part seems worthy to be placed on record.

REVIEWS AND NOTICES OF BOOKS.

Technique of the Teat and Capillary Glass Tube: being a Handbook for the Medical Research Laboratory and the Research Ward. By Sir Almroth E. Wright, M.D., F.R.S., with the co laboration of Leonard Colebrook, M.B., B.S. Second edition. Large 8vo. Pp. xxvi + 3?4. Illustrated in colour and in black and white. 1921. London: Constable & Co. Ltd. 42s. net.

Those who were acquainted with this book in its original form will welcome a second and much enlarged edition. In its general character they will find the work unchanged, but its scope is increased by the inclusion of much new matter. It is always a pleasure to read anything by Sir Almroth Wright, on account of the delightful if unu ual style in which he presents his subject. He is, it is true, addicted to the coinage of new terms; but these, he might tell us, are necessary because they stand for new ideas. We cannot, however, pass without remark his spelling 'pathogennesis': Liddell and Scott certainly afford ground for spelling it either with one *n* or two, but it is surely somewhat of an affectation to depart from the customary usage.

We may always turn to a preface by Sir Almroth, as we do to one by Bernard Shaw, with the assurance that we shall find food for reflection, and we are not disappointed here. He sets out to persuade us that real progress in treatment is to be expected solely, or almost solely, from the application of laboratory methods, and that clinical experience and statistical evidence are, in comparison, of little service. So persuasive is the charm of his style that, as we read, we are content to acknowledge the truth of much of his reasoning, though we think that he overstates his case. A surgeon might justly retort that the treatment of infected wounds dur ng the war was a story, if not of failure, at least of only partial success, so long as they were dealt with on the lines of laboratory teaching. It was not until the surgeon took matters into his own hands and cut the infected tissues right out, that real success was achieved. We make these remarks, not with the smallest wish to undervalue lab ratory methods, which we firmly believe to be indispensable for surgery as for medicine, but because we think Sir Almroth Wright goes too far in proclaiming their exclusive virtue. Surgery, as an art, applies every science which can serve its ends: it is not based on any one alone, though it is true that it finds its surest ground in pathology.

The work under rev ew is one essentially for the laboratory man, though the writers have incorporated three clinical appendices to chapter 7, dealing with the coagulability, alkalinity, and antitryptic power of the blood in a manner which is of direct interest to the surgeon. In the main the book explains, lucidly and with a wealth of admirable illustrations, the whole of the ingenious laboratory technique which has been evolved at St. Mary's Hospital under the inspiration and guidance of Sir Almroth Wright. It is a technique of a somewhat peculiar kind, specia y designed for the examination of minimal quantities of the blood or other body fluids. Such methods possess a manifest advantage in securing the material needed from a single drop of fluid, and it is claimed that the manifest disadvantage of relative lack of accuracy in measurement has been overcome by the device of coating pipettes and slides with a thin layer of paraffin, described for the first time in this edition. One is lost in amazement at the extraordinary ingenuity which has been brought to bear on the devising of the technique and on the overcoming of the little difficulties which constantly present themselves to the laboratory worker. This is a book which no such worker can afford to overlook, for, whether he employs the 'micro-technique' or not, he will find, almost on every page, 'tips' which will be invaluable to him in his daily work. The methods are described with such clearness that anyone who can use his hands should be able to carry them out after a reasonable amount of practice.

The test of a good laboratory technique is that it should suffice not merely for the daily routine of clinical pathology, but for the elucidation of more far-reaching principles of permanent value. And it must be admitted that in the hands of its originator this technique has led to the establishment of such principles, of which two may be mentioned as examples. Wright's application of the idea of measuring phagocytic power, first suggested by Sir W. B. Leishman, led to the conception of the opsonic index, and indirectly to notable modifications in the dosage of vaccines and tuberculin. Again, his studies on the conditions affecting blood-coagulation have gone far to place the treatment of certain forms of hæmorrhage upon a surer foundation. Others may prefer a technique which deals with larger volumes, and indeed, although the St. Mary's methods have been before pathologists for many years, and although the principles of many of them have been widely adopted, the 'micro-technique' itself has not come into general use elsewhere. But at least the methods described in the present volume must be admitted to have proved themselves adequate for research, no less than for routine use.

In the preparation of this edition, Sir Almroth has had the collaboration of Dr. Leonard Colebrook, one of his well-known disciples. New chapters have been added on subjects arising from studies on wound infections during the war, including the emigration and functions of leucocytes. The book makes no pretence at covering all the fields of laboratory work, being, indeed, almost limited to those in which Sir Almroth himself has laboured. It is a 'personal' work, strongly reflecting its author's individuality, and the many friends who know and admire Sir Almroth, even though they may not always see eye to eye with him, will be glad to possess and read it.

Studies in the Palæopathology of Egypt. By Sir Marc Armand Ruffer, Kt., C.M.G., M.D., late President of the Quarantine Council of Egypt; formerly Director of the British Institute of Preventive Medicine; Professor of Bacteriology in the Cairo Medical School; Member of the Indian Plague Commission, etc. Edited by Roy L. Moodie, Ph.D., Associate Professor of Anatomy in the University of Illinois. Imperial 8vo. Pp. 372, illustrated. Chicago: University of Chicago Press. $7.50 net.

This work is a memorial to Armand Ruffer. The material of it was provided by his own hands, the arrangement of it is the work of his widow and his friends. The preservation of mummies, and of their viscera in Canopic jars, has made a study of their gross anatomy and pathology a comparatively easy matter. It was owing chiefly to the example and incentive of Ruffer that matters were carried further than this. By various methods of his own devising the mummified tissues were so prepared as to be available for the methods of examination by dissection and by the microscope that a pathologist of to-day could apply to them. Dr. Roy Moodie, in the preface to this volume, says: "Sir Armand Ruffer made the first move towards establishing the science of palæopathology". It is a great claim and a just one. Pathological research owes much, and Egyptology something, to Ruffer. But in both sciences constant revision and sometimes revisal, of opinions are necessary; and it is more than probable that many just criticisms that can be made of the statements, chronological and pathological, in this book would be unnecessary if a revision of it by Ruffer himself had been possible.

Throughout the volume there is an absence of reference to the authorities which a reader might himself like to consult. A little quotation will illustrate the point (p. 30): "Egyptian navvies of ancient times toiled practically the same hours as the Egyptians do now. They enjoyed a holiday every seven days as do many nations at the present time." What authority is there for this statement, which in its obvious relations is important? We know of none. The fellah to-day, when not under Europeans, works seven days a week.

One of the most interesting chapters in the book is that on dwarfs. Here Ruffer brings new material of great value, and dissipates errors that had been bred by others. Breasted, whose work on Egyptology has earned the cordial acknowledgments of everyone, asserts that the dwarfs were representatives of a pygmy tribe existing in Yam (probably Central Africa), from whom captives were made from time to time. There is no evidence that the Egyptians ever went so far into Africa as this; and the dwarfs represented in all monuments are not pygmies but quite typical examples of achondroplasia. No one who saw the two photographs placed consecutively on the screen by Sir Berkeley Moynihan in his address at the Royal Society of Medicine last December can have the least hesitation in accepting this statement. The first slide was a photograph of two children suffering from achondroplasia, the second a photograph of three statues of the god Ptah and an Egytian dwarf. Every detail in the configuration of the bodies, heads, and limbs was identical. Ruffer is here certainly right, and Breasted wrong.

In his description of the famous 'dwarf of Zer' (*Plate VIII, Fig.* 2), Ruffer speaks of the drawing as 'wonderfully spirited'. This is true. We are only now beginning to realize the greatness of Egyptian artists. The collection exhibited last year by the Burlington Fine Art Society contained works (the majority of the specimens were the property of the Earl of Carnarvon) which were astonishing in their beauty, accuracy, and qualities of delight. Ruffer speaks of this figure as 'foreshortened'. This is inaccurate. Foreshortening was never attempted by the Egyptians; they were always truthful, so far as the limits of their art allowed them. Ruffer, indeed, had no great knowledge of Egyptian art. He speaks of difficulty in deciding the exact nature of the condition afflicting the 'Queen of Punt' (p. 45), and says: "The problem is rendered more difficult by the fact that the legs, abdomen, and head are drawn in profile and the chest almost full face." This is the case with every Egyptian drawing or bas-relief when depicting the human figure, so why make the exception here? The 'missing' portion of the bas reliefs showing the daughter of the Queen of Punt, which has 'unfortunately been lost', is in the collection of the Earl of Dufferin in Ireland.

The chapter on histological studies in Egyptian mummies is full of interest. The difficulties of preparing the material for examination were evidently considerable, and Ruffer concludes that no pathological diagnosis dependent upon a recognition of *cellular* changes is possible, but that microscopical examination may reveal changes due to infiltration of the tissues by new growths, inflammation, cirrhotic conditions, parasites, atheroma, and calcification. A doubt is left in the mind of the reader of this chapter as to whether the material Ruffer had to work with was the best possible. The specimens seem to have been poor, perhaps rightly so at the beginning of his

investigations, but his success with poor material was an ample warrant for the provision of the very best material available, and this he never appears to have had.

An examination of the bones of mummies reveals interesting results. Tuberculous disease was extremely rare, though a perfect example of Pott's disease with psoas abscess is demonstrated here; syphilis and rickets were unknown; osteo-arthritis was very common. In hieroglyphic writing the 'determinative' for old age is the picture of a man deformed by chronic arthritis.

A good discussion of consanguineous marriages is given, and the following conclusions among others are drawn: "The children from these incestuous marriages displayed no lack of mental energy. Both men and women were equally strong, capable, intelligent, and wicked. Certain pathological characteristics doubtless ran through the family. Gout and obesity weighed heavily on the Ptolemies, but the tendency to obesity existed before consanguineous unions had taken place. The male and female effigies on coins are those of very stout well-nourished persons. The theory that the offspring of incestuous marriages are short-lived receives no confirmation from the history of the Ptolemies."

Certain ascriptions of portraits are, we think, erroneous. *Plate LXIV*, *Fig.* 4, represents not Thutmose I, but Thutmose IV. *Plate LXV*, *Fig.* 9, represents not Thutmose IV, but Thutmose I or II.

The book is a delight to possess and to read. The criticisms are not intended to detract from its value, but are those which Ruffer himself would probably have made if he had been able to bring his knowledge abreast of the times. The publication has been admirably done, and the illustrations are excellent.

Manual of Operative Surgery. By JOHN FAIRBAIRN BINNIE, A.M., C.M., F.A.C.S. Eighth edition, revised and enlarged. 2 vols. Royal 8vo. Pp. xvii + 1311, with 1628 illustrations, some of which are coloured. 1921. London: H. K. Lewis & Co. Ltd. £3 3s. net.

THIS book is an old friend. In a few years it has reached an eighth edition; and so rapid have been the changes in the art of surgery during this time that a great many additions, deletions and revisions have been necessary. But old friends must be submitted to judgement, and their faults disclosed. This book has many faults, and in each succeeding edition they grow more numerous. There is much to be said in extenuation of its errors. New editions have been demanded so rapidly that the author has found it impossible to keep pace with them. He would have been wiser to have postponed the new edition until he was able to make it worthy of the reputation of the earlier volumes.

Only a few of the more serious faults, of which unhappily there are many, can be mentioned here. In the section dealing with the Gasserian ganglion, only brief reference is made to Frazier's work, none to Harvey Cushing's wonderful record of successful cases, nor to the met od of approach to the ganglion which he first described; and the name of Adson is not mentioned.

The 'scissors and paste' method of the book is flagrantly exemplified in the discussion of the operations for cancer of the tongue. "Only a few of them", we are told, "will be described," and we read the accounts of eleven. No attempt is made to discriminate between the several procedures, and no advice is given as to which operation is appropriate in certain conditions and inadmissible or disastrous in others. Butl n's operation is described at great length, and Crile's operation upon the glands is dismissed in a few lines. Kocher's operation, which in later years its author rarely, if ever, performed, is still described, despite the fact that Syme's operation was greatly preferred by Kocher himself.

The chapter on gastric surgery is lagging behind the times. The operation of gastroplication is described and illustrated. Who, nowadays, performs it? Mayo Robson is quoted from an article twenty years old as advocating gastrolysis, and the author says, "The mere breaking down of gastric adhesions often suffices to cure apparently inveterate cases of dyspepsia." The illustration "exposure of the beginning of the jejunum" is ridiculous. It is strange that an American author should borrow the trivial and antiquated sketches from Monod and Vanvert's book, when the artists of his own country are unsurpassed.

The operation of cholecystectomy is briefly described. Moynihan's method of removal from the cystic duct towards the fundus is discussed; but no mention is made of a danger to which he first drew attention, namely, the removal of a part of the common or hepatic duct when the sigmoid turn of the gall-bladder is adherent to the common duct; no indications are given as to the conditions which may occasionally make a removal from the fundus towards the cystic duct a better procedure. The operation of suprapubic prostatectomy is treated very summarily. The description of the operation is inadequate for the inexperienced surgeon, and offers no help or guidance to the surgeon who is no longer a novice. A great number of really important points are neglected, chief among them being the question of post-operative stricture.

Dr. Binnie is, we see, a graduate in Arts of Aberdeen University. He should therefore have a regard for the purity and rhythm and majesty of the English language, and he should use it with that right sense of sound and feeling that every Scotsman inherits. He is often slipshod and careless, and the cacophony of many sentences is disturbing.

The references given to original sources are too few. 'Codman's bursitis' is described, and its surgical treatment briefly mentioned. No reference is given to any publication by this author.

A lack of such aids to our search in the literature is one of the greatest annoyances to any reader.

This book is one of real value, but of a steadily depreciating value. The author will, we most sincerely hope, take greater pains with the next edition. A far more scrupulous choice in the operations to be described is necessary; better illustrations should be prepared for almost every section; references in the text or at the end of the volume, or both, should be given; and the advice of Syme that an effort should always be made to reduce the size of every succeeding edition of a book may with advantage be remembered. Brevity is the soul of more than wit.

Clinical Surgical Diagnosis. By Professor F. DE QUERVAIN, Berne University. Third English edition, translated from the seventh edition by J. SNOWMAN, M.D. Royal 8vo. With 731 illustrations and 7 plates. 1921. London: John Bale, Sons & Danielsson Ltd. 50s. net.

A BRIEF review of this work will suffice. It is one which can be most confidently recommended to students and practitioners; for it is unrivalled. No book on surgical diagnosis equals it in fullness, accuracy, and insight. The discussions are admirable, the clinical acumen penetrating and sagacious, and the illustrations are excellent. It is rather a large book, and its price, though not high for the vast amount of material it contains, is considerable for students of to-day. The volume should be in the hands of every student; and a reduction of its price, if possible, would probably help to bring about this result.

Keen's Surgery, its Principles and Practice. By Various Authors. Supplementary volumes VII and VIII. Edited by W. W. KEEN, M.D., LL.D., Hon. F.R.C.S. Eng. and Edin., Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Large 8vo. Pp. 1800, with 996 illustrations, and separate desk index. 1921. Philadelphia and London: W. B. Saunders Co. Per set: Cloth, £6 6s.; Half Morocco, £7 15s.

IN his preface to these volumes Professor Keen says: "The first six volumes of this work recorded the progress of surgery down to 1913. Then came the Great War and its remarkable contributions both to the science and the art of surgery. Without a record of that enormous progress this work would have been a torso." It is almost ungracious to disagree with so great an authority and so charming a personality, but it is an open question whether the results obtained in the war justify the immense amount of work and lavish expenditure of space here devoted to them. To our mind there is in such extravagance even a danger of darkening counsel and obscuring first principles. To those who went through the surgery of the war with open minds the chief impression must always be gratitude that so little that was new, and nothing that was revolutionary, did arise. The more experience grew, the clearer it became that the great primary principles of surgery held true in war as in peace, and that all that differed in the two cases was the method of adapting the means to the end. As the Editor truly says, "Pasteur and Lister were triumphantly vindicated." This being so, surely it were well to relegate to its proper peace-time limits the surgery of the Great War; already it is becoming abundantly evident how small a part its lessons are destined to play in the surgery of civil life. Careful perusal of these two volumes leads strongly to the opinion that the work would have gained greatly had the war sections been eliminated and relegated to a separate work.

For many years *Keen's Surgery* has been a classic work. It numbers on its staff no less than 129 contributors—a formidable team for one of even Professor Keen's well-known quality to control. The advantage of such a work as this is that each subject is dealt with by the writer who is best qualified to do so. Its disadvantages are an inevitable difference of opinion in overlapping questions, and the impossibility of rewriting so gigantic a work every decade or so in order to keep it fully up-to-date. Therefore the volumes before us have been issued to supplement by their new knowledge the information contained in the previous six. We cannot say that the method makes for clarity. To read the original article written many years ago and then to supplement it by the addition written yesterday is hardly ideal; but is perhaps the best that can be done under the circumstances.

Two typical examples of the evils of entrusting the writing of a modern surgery to a large number of 'specialists', that is so popular nowadays, are to be found in the chapters devoted to gas gangrene and affections of the thyroid respectively. Gas gangrene is dealt with to some extent and quite clearly by Professor Adami in chapter 1 ("Inflammation"). In chapter 6 ("Gas Gangrene") Sir Cuthbert Wallace gives an excellent account of the affection, to which a good bibliography is appended. Nevertheless the same subject is again treated by Captain Beebe in chapter 12 ("Bacteriology of War Wounds"), by Gibson in chapter 15 ("Surgical Technic"), by Blake in chapter 17 ("Gunshot Fractures"), and by Binnie in chapter 25 ("Surgery of Muscles"). One single chapter would have been ample, and far less mystifying to the reader. Similarly, affections of the thyroid are brought in by Vinson in chapter 26 ("The Endocrine System of Glands"), by C. H. Mayo in chapter 27 ("Surgery of the Thyroid"), by Wilson in

chapter 28 ("Recent Advances in our Knowledge of the Pathology of Goitre"), and by Kendall in chapter 29 ("The Chemical Nature of the Thyroid Secretion"). A much more clean-cut view of the position to-day could be given within the limits of a single chapter.

But these are defects inherent in the system. In the volumes themselves—particularly Vol. VIII—there is much of interest and value. Adson's chapter on the surgery of the hypophysis is excellent, if somewhat optimistic, and too much confined to the merits of the intracranial route.

The surgery of the head is brought up to date by Neuhof. The best portion of this deals with Cushing's classic work. Much space is devoted to the highly theoretical work of Dandy on hydrocephalus.

Frazier deals with the surgery of the fifth nerve. He describes his operation upon the sensory root of the Gasserian ganglion, and his clear practical details give an added value to his description. His chapter on tumours of the Gasserian ganglion is also excellent. The chapter on the technique of bone-grafting by Warbasse is disappointing. It is wanting in precise details, and the indications for dealing with septic cavities in bone—one of the most important and difficult of procedures—is particularly unsatisfying. There is an excellent account of the surgery of the face and jaws, including Esser's 'epithelial inlay' method. Direct laryngoscopy, bronchoscopy, and œsophagoscopy is in the hands of Chevalier Jackson and is excellently done. Heuer gives a full discussion of the difficult subject of wounds of the chest. Deaver and Pfeiffer give a good description of difficult cases of appendicitis. A fuller discussion of when not to remove the appendix would be acceptable. W. J. Mayo and D. C. Balfour give some useful additional points on the treatment of cholecystitis, and also various reconstructive methods for the bile-ducts. Pearce and Austin write an excellent account of the relative values of the various tests for renal efficiency, and their article also contains a comprehensive dissertation on acidosis.

The volumes are worthy companions of their predecessors, and will stand for many years as a monument to their authors and their Editor. We congratulate Professor Keen very heartily on a worthy completion of a great task.

On Modern Methods of Treating Fractures. By Ernest W. Hey Groves, M.S., M.D., B.Sc. (Lond.), F.R.C.S. (Eng.), Surgeon to the Bristol General Hospital. Second edition. Large 8vo. Pp. 435, with 296 illustrations. 1921. Bristol: John Wright & Sons Ltd. 30s. net.

Since the first edition of this work, published in 1916, the vast amount of material produced by the Great War has provided ample opportunity for the further study of the treatment of fractures. Advantage of this glut of material has been taken, and the author has brought the book thoroughly up to date. The second edition has been largely rewritten, and is now a volume of some 435 pages with 296 illustrations. There are thirteen chapters, each of which is beautifully illustrated with drawings of specimens and excellent reproductions of *x*-ray photographs. The introductory chapter compares the teaching of yesterday with that of to-day, and amongst other points great stress is laid on the danger and futility of prolonged fixation in the treatment of fractures, resulting too often in mal-union or non-union, ankylosed joints, and wasted limbs. The importance of the taking of *x*-ray pictures at once in every case of suspected fracture is pointed out, also the danger arising from delay in taking this precaution until some obvious disability has shown itself. A good anatomical result usually means a good functional result; in some cases, however, of good anatomical result the functional result is bad. But restoration of anatomical structure is only the beginning of the treatment of fractures; and massage, mobilization, and active movements take an almost equally important place in their modern treatment. To obtain the best results three things are necessary: the will of the patient, sufficiently perfect restoration of the form of the bone to allow of perfect joint action, and the preservation of the full vitality of the circulation and the neuromuscular apparatus. Co-operation between the systems, massage, extension, and operation are essential.

Massage as advocated by the author is very different from that frequently understood by the average practitioner. The correct method of its application is not a daily rubbing, punching, or pummelling of the limb, but a gentle superficial stroking—a soothing caress to the injured part—from the very onset. This, when properly performed, never causes pain; on the contrary it relieves it, and, as it were, lulls the part to sleep, thus relieving all muscular spasm. This form of massage is applicable to every fracture from the time of the accident, and in some is the only treatment required. We do not think that the gentle superficial stroking has yet received the notice that it deserves, and too often a fracture is left in splints until union is becoming advanced before massage is advised. By this time muscles have wasted, tendons are becoming fixed, and circulation is poor. Gentle massage from the beginning is the keynote to success.

The treatment by extension is fully dealt with. It is pointed out that when applying extension by means of plaster, the latter should be applied to a height on the limb well above the site of fracture thus pulling downwards a tube of soft parts as well as the lower fragment. The application of plaster up to the site of fracture, as is not infrequently seen, is wrong, as it only pulls on the lower ends of the muscles and does not overcome the resistance of the elastic retraction of the skin and fascia. Transfixion pins, stirrups, callipers, and traction clamps, with their methods of application, are described. We fail to find, however, any mention of traction in fractured femurs by

pulling from screws inserted into the tibial crest just below the tubercle. This method has undoubtedly proved to be most efficient.

In the chapter on experimental observations on operative treatment, large numbers of experiments on animals are described in detail, with excellent diagrams, *x*-ray pictures, and microphotographs. The author's experiments go to support Macewen's view that callus is formed from the bone and not from periosteum. Specimens are illustrated showing the formation of new bone by means of ossification of cartilage cells, and this can be seen to be taking place from the bone outwards towards the periosteum and not in the reverse direction.

The author insists on the utmost care being exercised to avoid any possibility of septic infection. Many cases of sepsis occur, not as a result of infection at the time of operation, but because of insecure fixation and the use of foreign bodies which become loose in the tissues. If the bones are securely fixed together with no possibility of the uniting medium becoming loose, healing will take place and no sepsis will occur. The secure fixation of the fragments is one of the most important factors in obtaining aseptic healing. He does not agree that the gloved fingers should not be introduced into the wound; practice and the use of efficient instruments has reduced the possibility of tearing the gloves to a minimum, and the advantages of the use of the gloved hand at certain stages of the operation cannot be overestimated. Many methods of fixation are described—intramedullary pegs, plates, screws, plate-clips, and wires—annealed iron wire being preferred to the silver wire commonly in use.

Nearly one hundred pages are devoted to experimental observations on bone-grafting and bone-grafting operations for fractures, much of which constituted the author's Jacksonian Lecture on the subject. Short accounts are given of the work of Ollier, Barth, Axhausen, and Macewen, and the author reconstructs an account of the growth of bone from the work of these authors. He comes to the conclusion that the ideal graft is a piece of living bone used in its entire thickness, that cortical grafts are better than intramedullary, and that firm fixation of the graft by metal sutures is essential to success; catgut does not give sufficient firmness. If there is any doubt as to the asepticity of a healed compound fracture requiring bone-grafting, the two-stage operation is advocated rather than waiting for autosterilization.

Three chapters are devoted to the treatment of fractures of the upper and lower limbs—splints and retentive apparatus are described, together with details of the operative treatment, and bone-grafting of each important bone. Thomas's swivel arm splint for fractured humerus is not advocated except for transport purposes, as stiff elbows and delayed union have occurred after its use. The advantages and disadvantages of the Thomas knee-splint for fractured femur are discussed.

We find no reference to the Sinclair net bed for the treatment of compound fractures of the upper end of the femur. This bed has proved to be most efficient in these cases, especially when associated with large wounds of the buttocks requiring frequent dressing.

Short accounts of excision of wounds, and treatment by means of B.I.P.P., flavine, and Carrel-Dakin solution are given in the chapter on compound fractures. Stress is laid on the importance of not removing any fragments of bone which have any vascular connections. The operative fixation of septic open fractures is rightly condemned.

The book is one of the best we have read on the subject. The author has done an enormous amount of experimental work, the results of which he has described clearly and concisely. The conclusions he has come to are definitely stated, and the work will prove itself invaluable not only to operating surgeons but to all who are interested in this, until recently, somewhat neglected subject. It is a book that every practitioner should possess.

Manual of Surgery. By ALEXIS THOMSON, F.R.C.S., Professor of Surgery, University of Edinburgh, Surgeon to the Royal Infirmary, Edinburgh; and ALEXANDER MILES, F.R.C.S., Surgeon to the Royal Infirmary, Edinburgh. Sixth edition. In three volumes. Vol I, *General Surgery*, pp. 565, figs. 169. Vol. II, *Extremities, Head and Neck*, pp. 659, figs. 288. Vol. III, *Thorax and Abdomen*, pp. 566, figs. 161. 1921. London: Henry Frowde and Hodder & Stoughton. Vol. III. 12s. 6d. net.

THIS text-book of surgery, representing the Edinburgh school, is so well known as to require little general description. It is the first edition published since the war, and the surgical lessons of the campaign are among the new material scattered throughout its pages; but only such of these principles are referred to as are of importance in dealing with the injuries of civil life. The illustrations, which exceed 600 in number, are one of the great features of the book. They are so good as to form a positive lure to a reading of the text. Possibly there is rather too large a proportion of rare and exceptional cases figured, whereas a greater number of pictures and diagrams of typical conditions might be more useful to the student. A good up-to-date account of current surgical teaching is given, with a judicious tendency to non-committal in regard to extreme views. Thus, the various conditions associated with intestinal stasis and mobility of the abdominal viscera are well described and illustrated; but the uncertainty of theories and the insufficiency of evidence as regards practical treatment are clearly indicated.

The details of operative surgery are not mentioned, as these are dealt with in another manual of the same series.

We are quite sure that the present edition will greatly increase the popularity of this work

A Guide to Diseases of the Nose and Throat, and their Treatment. By CHARLES A. PARKER, F.R.C.S. and LIONEL COLLEDGE, F.R.C.S., Throat Hospital, Golden Square. Second edition. Demy 8vo. Pp. xv + 583, illustrated. 1921. London: Edward Arnold & Co. 25s. net.

IN publishing a second edition of his well-known work Mr. Parker has been fortunate in securing the collaboration of Mr. Colledge, and they may be congratulated upon the result.

Chapter 1 is concerned with the examination of the upper respiratory tract; it is clear, concise, eminently practical, and well illustrated. *Fig.* 14 is open to criticism as a representation of 'the normal nasopharynx,' and the method for indirect examination of the lower end of the trachea is insufficiently described. In many instances this region can only be seen in the mirror if the patient stands and leans well forward while the surgeon kneels or stoops *much* below the level of the patient's glottis.

Chapter 2 deals with methods of local treatment, and a useful list of formulæ is given. We suggest that these might better be included with the affections for which they are used, thus rendering the whole subject more intimate and nteresting.

Operative treatment is described in chapter 3, which contains much useful and practical information. We note that novocain is not mentioned under 'Local anæsthesia', and we fail to understand why for general anæsthesia "it is advisable to start with gas or C.E. and give a final dose of pure ether." It is widely agreed that C.E. is by no means a safe mixture, therefore why not charge up the patient with a stimulating anæsthetic like pure ether (open method) and then follow with just enough chloroform (a depressant) to keep the patient 'under' during the actual operation? The authors stress the fact that laryngotomy should not be performed in infants and only as a temporary expedient in adults. How many intractable cases of stenosis of the larynx and the upper portion of the trachea would have been avoided if this warning had been heeded!

The technique of the operations for laryngotomy, tracheotomy, intubation and laryngostomy are well described, and the indications for and against these measures are obviously the result of personal experience. An excellent résumé of diathermy concludes the chapter.

In chapter 5 we have an excellent description of tuberculosis of the upper air-passages and their treatment, but we doubt if all surgeons would agree that the external operation for retro-pharyngeal abscess is always to be preferred to the internal or transoral method. The latter method is frequently employed for abscesses due to pyogenic infection and the external operation is reserved for tuberculous cases. The results justify this discrimination.

Chapter 7, "Complications Occurring in Organic and Chronic Constitutional Disorders", should be read and re-read by all who contemplate specializing in diseases of the throat and nose. The authors prove to the hilt how necessary it is that the true specialist should be one who has previously acquired a sound practical knowledge of general medicine.

Section III is devoted to diseases of the nose, and those chapters which are confined to the acute and chronic inflammatory affections give a concise and well-balanced account of their present-day treatment. The chapter on the diseases of the accessory sinuses of the nose reflects current views and treatment. We note that no mention is made of pain in the ear as a symptom of sphenoidal sinus suppuration, nor is reference made to the possibility of that intractable and frequent complication of the Caldwell-Luc operation for chronic maxillary antral suppuration, viz., the formation of an unpleasant-smelling, shell-like crust of dried discharge which has to be expelled every four or five days. It should be emphasized that this trouble is most likely to occur when the whole mucosa of the sinus is removed and its place taken by granulation tissue. Furthermore, it should be pointed out that epiphora from cicatricial stenosis of the lower end of the lachrymal duct has not infrequently followed the Denker operation. Many cases of aspergillosis of the antrum have been recorded, but the affection seems to have been overlooked by the authors.

In describing the exploration and treatment of the frontal sinus (p. 271), the common mistake is again made of using the terms 'infundibulum' and 'front nasal canal' as if they were identical—the infundibulum is a groove or gutter formed internally by the uncinate process and externally by the 'bulla ethmoidalis', while the frontonasal canal lies above it and is a quite independent structure, even though it may be continuous with the infundibulum. The authors rightly condemn external operation on the frontal sinus as a routine procedure and advise it only when other intranasal measures have failed, and local or general symptoms indicate the more serious and complicated operation.

The chapter on the reflex nasal neuroses, e.g., asthma, paroxysmal rhinorrhœa, hay fever, etc., is excellent. The anaphylactic origin of these conditions is clearly stated, and it may be hoped that one result of such knowledge will be to decrease the number of unnecessary nasal operations which have been performed in past years.

In a later edition the authors will no doubt give greater prominence to the treatment of malignant disease of the nose by radium and the recently-introduced Erlangen *x* ray method.

In diseases of the nasopharynx adenoids naturally take first place, and a full description of symptoms, diagnosis, and treatment is given. In the latter it would have been well to lay some stress on a thorough removal of the lymphoid tissue in Rosenmüller's fossæ, because experience amply proves that aural symptoms may continue, or develop later on, when this detail has been neglected, and often in those very cases where an imposing but centrally-situated mass of vegetation has been removed.

We do not think that many rhinologists will agree with the authors' advice that when a

fibroma is "chiefly confined to the nasopharynx, it should be removed through the mouth after splitting the soft palate": a better route is by way of the nasal cavity. In endothelioma of the nasopharynx no mention is made of the very characteristic early symptom, viz., unilateral deafness and the accumulation of mucus in the tympanum, together with anæsthesia of the second division of the fifth nerve and mechanical weakness of the levator palati muscle—a triad of symptoms which are pathognomonic of the disease.

The operative treatment of diseased tonsils is well described; but we maintain that there is only one satisfactory method of dealing with serious post-operative hæmorrhage, viz., to find the bleeding vessel and ligature it rather than to apply any form of compression clamp or to suture the pillars of the fauces over a "roll of ribbon gauze." To insert Michel's clips through the pillars is scarcely in accord with surgical principles.

The chapter dealing with the surgical treatment of malignant growths of the pharynx is of great value to all who are interested in this subject, and the illustrations are excellent.

Diseases of the œsophagus and of the larnyx are described in a clear and exhaustive manner. In the treatment of papillomata of the larynx no reference is made to the value of the intra-laryngeal application of radium—probably the most efficient method of treating this troublesome affection.

Not only the 'post-graduate student', but the specialist also will find pleasure and profit in this excellent volume.

The Submucous Resection of the Nasal Septum. By W. MEDLAUGH DUNNING, M.D. (N.Y.). Crown 8vo. Pp. 97, illustrated. 1921. New York Surgery Publishing Co.

IN this little volume the author lays stress on the importance of normal nasal respiration, and points out that this is most frequently interfered with by irregularities of the septum. He describes the usual forms which such obstructions may take; they are well illustrated, and the operative technique for their removal is clearly described, and based on sound surgical principles.

Chapter 1 deals with the normal anatomy of the nose and the nasal fossæ, but we would suggest that on pp. 9 and 14 considerable ambiguity is introduced by using the words 'vibrissæ' and 'cilia' as indicating correlative structures. Nor do we agree "that the greater part of the septal circulation comes from above", i.e., the nasal branch of the ophthalmic artery. Surely it is derived from the "artery of the septum"—a contention which would be acquiesced in by any surgeon who has had to deal with many cases of epistaxis or post-operative nasal hæmorrhage.

Dr. Dunning would seem to adhere to the 'reflex' origin of asthma in regard to nasal obstruction of septal origin, whereas most rhinologists would incline to the view that asthma is a symptom of anaphylaxis, and when the removal of a septal obstruction is followed by the relief or cure of the bronchial spasm, the result is brought about by the withdrawal of the specific protein to which the patient is peculiarly sensitive. This protein is often of bacterial origin, and its disappearance coincides with the more efficient drainage and aeration of the nasal cavities. The technique of submucous resection as practised by the author does not reveal anything new to us, and while rightly pointing out the possible dangers of cocaine as a local anæsthetic, he does not mention that very valuable and non-toxic analgesic, novocain. Furthermore, if a preliminary hypodermic injection of morphia and atropine be given, there will be need for less local anæsthesia of any kind.

We do not think sufficient stress is laid on the chief causes of failure of submucous resection in relieving the nasal obstruction. Two at least should have been emphasized: (1) The removal of the premaxillary process at the posterior, internal, and lower portion of the vestibule; (2) The anterior end of the inferior turbinal on the concave aspect of the deviation.

Such practical details might well take the place of chapter 5, 'Special Surgical Procedures', because, in the author's own phrase, the manipulations are "hard to translate from action to words."

We entirely agree with the statement that only in extreme cases of obstruction should septal operations be performed in young children.

Intrinsic Cancer of the Larynx, and the Operation of Laryngofissure. By IRWIN MOORE, M.D., C.M., Edin., Surgeon to the Hospital for Diseases of the Throat, Golden Square, W. Royal 8vo. Pp. xii + 147. 1921. University of London Press. 20s. net.

THIS monograph is a re-issue in amplified form of a series of articles originally published in the *Journal of Laryngology, Rhinology and Otology*, in 1918. It is a work of thorough and conscientious detail, and there can be no doubt it was well worth being made available in its present convenient form. Though the frequency, classification, and diagnosis of laryngeal cancer are discussed, the chief interest of the book lies in the very full history it gives of the operation of laryngofissure and the minutely detailed description of the technique of this procedure.

Dr. Irwin Moore gives due prominence to the fact that, although Arthur Durham had established the usefulness of the operation as early as 1872, a period of 18 years was to elapse before the work of Butlin and Semon began to make current what is now recognized as the most generally valuable of the methods of treating intrinsic laryngeal cancers. There can be few operations with

regard to which professional opinion has passed so completely from authoritative condemnation to universal approbation. In connection with this change of opinion, it is interesting to note that the replacement of laryngectomy by laryngofissure involves an important advance of principle. Laryngofissure ensures adequate exposure and definition of the disease before its removal is begun, and allows the excision to be carried out in exact accord with the needs of the individual case. Laryngectomy, on the other hand, is a formal anatomical procedure, and relatively incapable of exact adjustment to the individual case. There can be no doubt that the precise determination of the situation and extent of the lesion should be a recognized step in all operations designed to deal with malignant disease of the larynx or pharynx.

Dr. Moore's description of the technique of the operation is exhaustive and precise. That his experience has been thoroughly assimilated is shown by the numerous practical hints he puts before the reader, and the many ingenious instruments he has devised and brought into use. If one might feel inclined to any criticism of this part of the book, it would be on the ground that the conscientious and even meticulous minuteness of the description might give to the inexperienced the impression that the operation is more formidable than in actual practice it is found to be. However this may be, the emphasis that is laid upon the need for considerable organization and the mastery of detail is in every way sound and admirable.

Although it is not a legitimate criticism it may yet be regretted that Dr. Moore has limited himself so strictly to the themes indicated by his title. There can be little doubt that a full discussion of all the means available for the treatment of intrinsic cancer of the larynx is once more becoming necessary. The value of laryngofissure is established beyond all question; but there is perhaps a tendency to regard it as the only really hopeful method available, and to ignore as relatively uninteresting the not very infrequent cases to which it is manifestly inapplicable. Surgical feeling will certainly come to regard the dreadful mutilation of total laryngectomy as less and less admissible in treating a form of cancer that in its more favourable types is curable by so benign a measure as laryngofissure. Some form of operation would seem to be needed intermediate in range between these two—capable of more extensive application than laryngofissure, without involving the functional disability of laryngectomy. The application of plastic surgery to the reconstitution of the larynx after extensive resections is already plainly indicated as the direction in which the solution of the problem is to be found.

It would have been of value to learn Dr. Moore's views as to the treatment of those cases that are excluded from the range of laryngofissure, such, for example, as cases of very extensive local disease, of recurrence after laryngofissure, and of precocious involvement of the cartilage. These are undoubtedly of very special, perhaps even of predominant interest, as they involve problems yet unsolved.

The fact that gives to intrinsic laryngeal cancer a great part of its special interest to the surgeon is its relative benignity—a character very well shown in the various series of results quoted by Dr. Moore. He accepts without question the current view that this comparatively benign quality has a purely anatomical explanation and depends on the isolation of the cancer within the resistant cartilaginous box of the larynx and the sparseness of the lymphatic channels leading from it. This view leaves unexplained the occasional occurrence of extremely malignant cancers within the larynx, and is far from unobjectionable on general grounds.

Some of these ultra-malignant growths, although they may present clinically, and even at operation, all the appearances of the intrinsic cancers, are in fact of pharyngeal origin and start in the deepest part of the pyriform sinus. It seems not to be at all generally known that a growth originating here may fail to make any appearance in the pharynx at all, but may at a very early stage penetrate the lateral wall of the larynx on the one hand and the thyroid ala on the other. Such tumours provide an almost impossible task for the diagnostician; we should have specially welcomed some discussion of them by Dr. Moore, as they are absolutely unsuited for treatment by laryngofissure, and constitute one of the very worst conditions the surgeon can meet with in that operation.

The Venereal Clinic: A Handbook of Venereal Disease in Relation to the Individual and the Community. By Several Writers. Edited by ERNEST R. T. CLARKSON, M.A., M.R.C.S. With an Introduction by Sir SQUIRE SPRIGGE. Demy 8vo. Pp. xiii + 477, with 20 plates, some in colour. 1922. London: John Bale, Sons & Danielsson Ltd. 25s. net.

THIS work is a collection of monographs by specialists actively engaged in the treatment of venereal diseases, for the instruction of students and practitioners, and the authors have aimed to convey as concisely as possible such information as will enable anyone to manage safely the majority of cases dealt with in a V.D. clinic. The result is a work which should prove of great practical value to those for whom it is intended.

The book is divided into two portions—medical, dealing with diagnosis and treatment, and sociological. The syphilis section of the medical portion has been written by Dr. Malcolm Simpson and Dr. H. C. Semon, with a preface by Dr. Sequeira, and describes mainly the practice of the London Hospital. A good feature is the differential diagnosis of secondary and tertiary skin lesions, always troublesome to the inexperienced. In a small work it is notoriously difficult to select the points to emphasize and those to pass lightly over, but we should have thought the diagnosis of syphilis of the mouth region from carcinoma worthy of note. The treatment, which is outlined in the second portion of this article, shows a faith in the power of a few doses of '914'

or galyl, and of mercury, to cure an early case of syphilis, and a trust in the Wassermann test as a guide to cure which we confess we do not altogether share. For a primary case in an adult male the treatment is 0·6, 0·9, 0·9, 0·9 grm. '914' at weekly intervals, and eight weekly injections of mercury (or two months' pills), after which no further treatment is given unless the Wassermann reaction becomes positive. A secondary case receives the same initial course, and this is repeated after two months, when treatment is suspended, unless two months later or on a subsequent test the blood reaction is found to be positive.

If we could only know how much injury to the parasite of syphilis was indicated by a negative Wassermann reaction, we should be saved much uncertainty of thought regarding the progress of our patients. Our positive knowledge, however, is that many cases relapse from negative to positive many months after treatment has been stopped; we often discover the positive reaction only when the patient returns with clinical symptoms, having defaulted from the clinic in the meantime, and in such cases we may have the opportunity of learning that our patient, whose Wassermann reaction was negative the last time we saw him, has defeated the aim of the V.D. scheme by adding at least one other to the syphilitic population. Such experiences as these make us wish that—since we cannot keep our patients from sexual intercourse by force, or compel them to attend at regular intervals, or get out of their heads that negative blood means cure (particularly if we show ourselves to be so greatly guided by it)—those who treat syphilis would make a little more sure of eradicating the disease before stopping treatment, even if a few were over-treated in the process.

The section on gonorrhœa in the male is written by the editor, with a chapter on the urethroscope by Mr. Wyndham Powell. Both articles are thoroughly practical and, if the lessons which they convey are well learnt, we can hope to see less of the transmission of gonorrhœa to innocent partners, for which many practitioners cannot be held altogether blameless. The general public will continue to regard lightly and to transmit the disease until the medical profession, impressed itself by such teaching as Dr. Clarkson's and Mr. Powell's, tells it with one voice that cure is a difficult matter to determine and that sexual intercourse before cure is a social crime.

The reader of many works on gonorrhœa may be confused by the difference in practice of various clinics in regard to irrigation. In one book he reads that weak solutions should be used, and in this work he is advised to employ concentrations which the first book told him were too strong. One author tells him to employ posterior irrigation as soon as he can persuade the sphincter to open; this work gives him the impression that posterior irrigation is no light matter, and not to be undertaken without clear indications. We think that, in regard to the last-mentioned divergence of opinion, a reconciliation might be found in the first, viz., the concentration of the solution, since it is probable that irrigation with a strong solution really is a serious matter.

Dr. M. Rawlins' article on gonorrhœa in women contains many valuable hints on a subject which is much neglected. Some remarks on tests of cure would be useful in a future edition. Mr. Roxburgh deals with gonococcal eye infections, and Dr. Panton with the bacteriology of V.D.

The section on the sociological and administrative side of venereal diseases contains a large amount of useful information not easily to be found elsewhere. It includes an exposition of the two opposing views on the question of prophylaxis by disinfection, and some remarks on the principles which the editor thinks should govern the general management of the V.D. problem.

There are five appendices—on the organization of V.D. clinics, syphilis and gonorrhœa sections; a specimen leaflet in relation to immediate self-disinfection; on the making of dilutions from concentrated solutions; on the restriction of 'prostitution'; and a general bibliography.

Altogether, the editor and his colleagues are to be congratulated on having produced in such convenient compass a work which is full of practical information.

A Pocket Surgery. By DUNCAN FITZWILLIAMS, C.M.G., F.R.C.S. (Ed.), Surgeon in Charge of Out-patients, and Lecturer in Clinical and Operative Surgery, St. Mary's Hospital, London. Crown 8vo. Pp. 348. 1921. London: Edward Arnold & Co. 10s. 6d. net.

THIS is an attempt to confine within a very small compass the whole range of examination surgery. In this endeavour the author has been very successful. Every essential of surgery is summarized briefly and accurately, and, provided that a student has read a larger book carefully and done his clinical work well, this pocket book should be of great use to him as "a key to the cupboard" in his brain.

Handbook for the Limbless. Edited by G. HOWSON, formerly Officer in Charge of the Curative Workshops, Special Surgical Hospital, Shepherd's Bush. With a Foreword by JOHN GALSWORTHY. Pp. 225. 1921. Published by the Disabled Society, 48, Grosvenor Square, London, W. 1s. net.

THIS little book, in the production of which a number of writers have shared, is intended as a guide both to limbless patients and to the medical men who have charge of them. In addition to short descriptions of various patterns of artificial arms and legs, it gives sound advice and suggestions in regard to physical training, occupations, and recreations suitable for men who have lost one or more limbs. It concludes with short references to organizations which are prepared to help the limbless in various ways. It ought to be of great service to disabled men and those responsible for their care.

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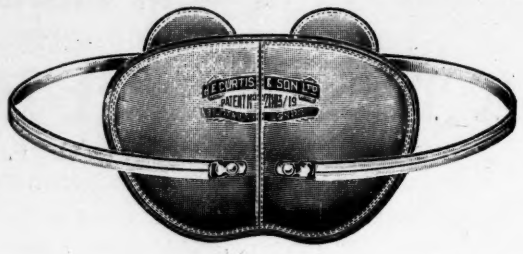

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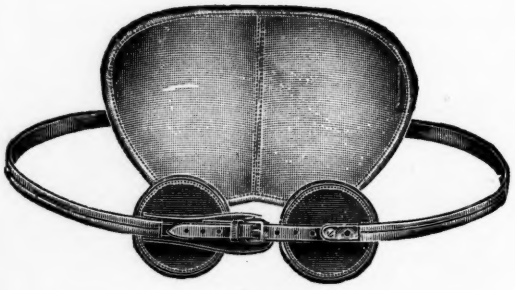

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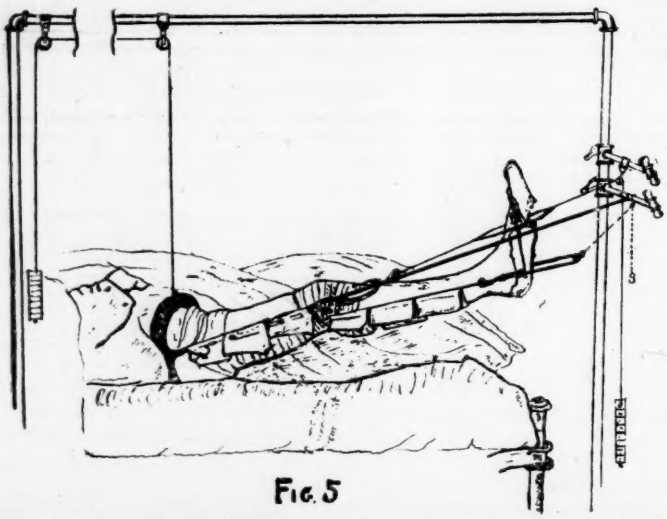

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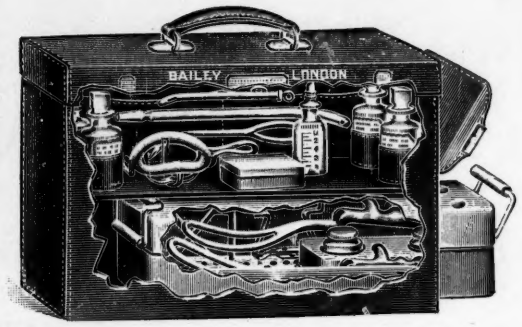

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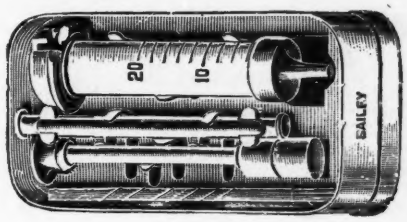

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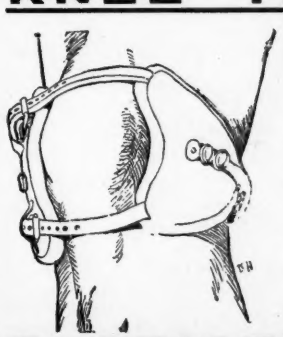

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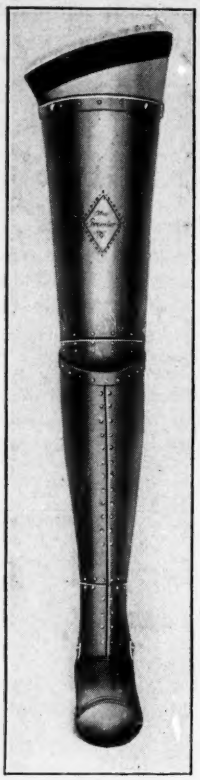

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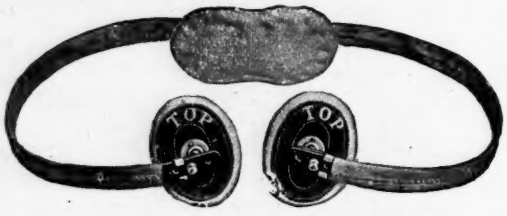

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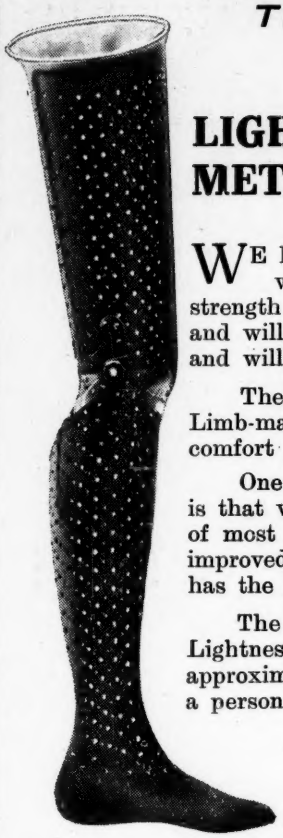

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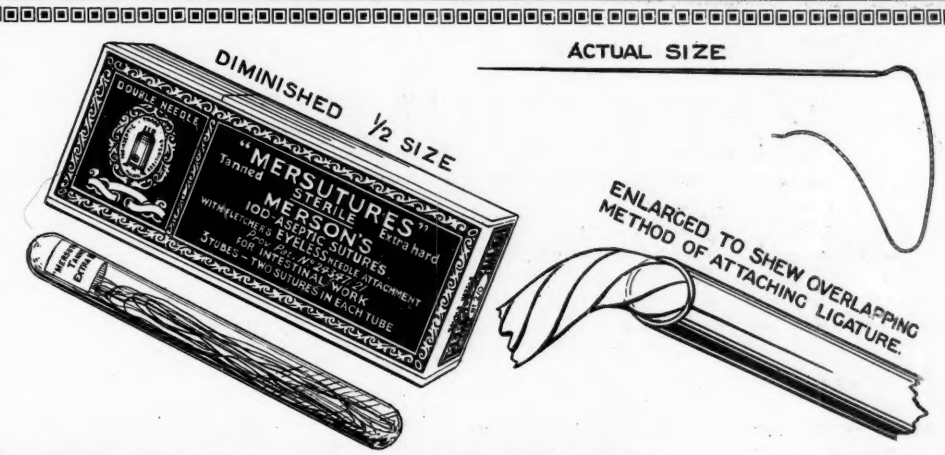

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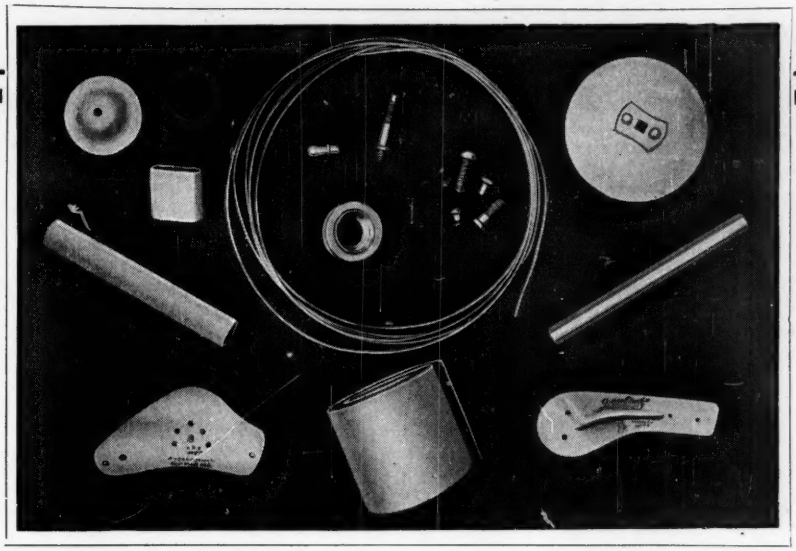

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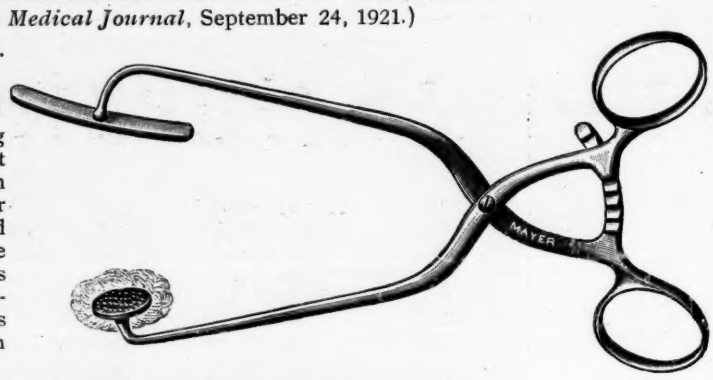

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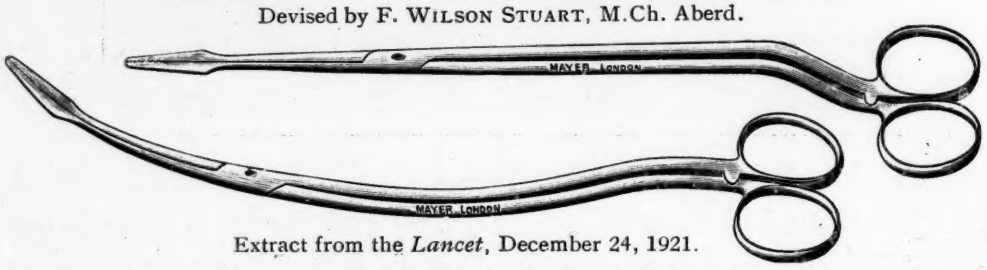

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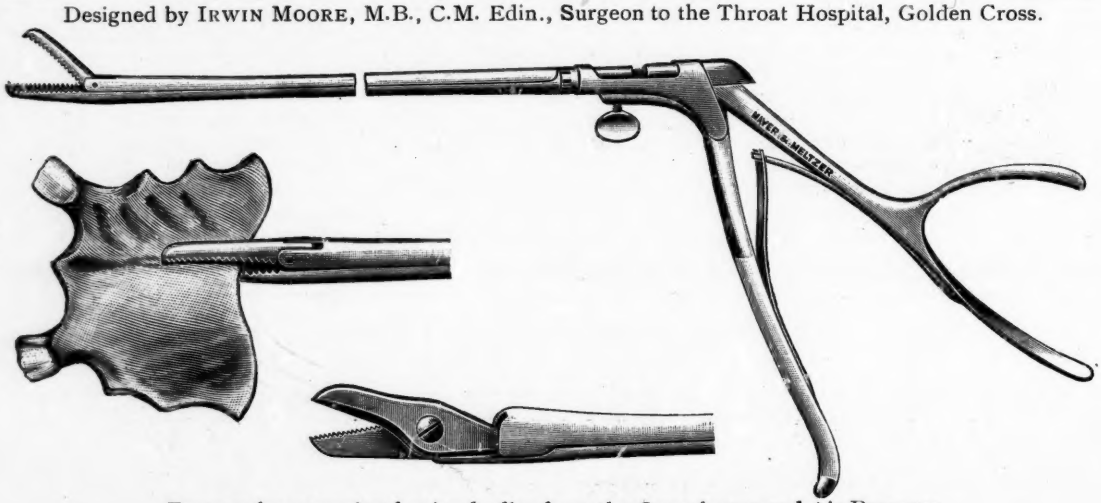

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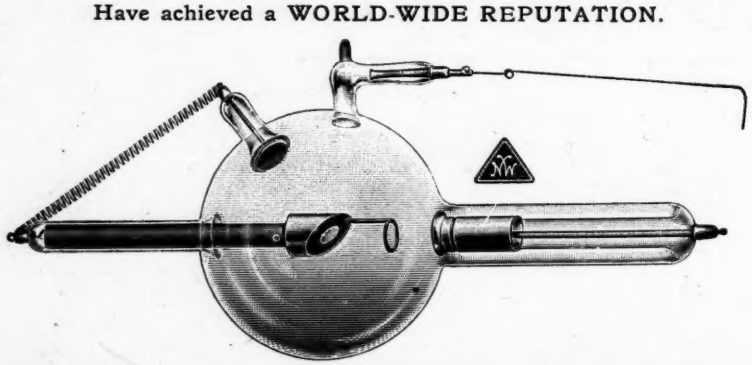

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